73® AMATEUR RADIO

International Edition

APRIL 1989
ISSUE #343
USA $2.95
CAN $3.95

A WGE Publication

VHF AND ABOVE ANTENNAS!

- Wide-band discone
- Hot VHF/UHF HT antenna
- Tri-band vertical
- Great VHF RFDer

HOME-BREW:

- Uniden 10FM split mod!
- New life for Bird elements
- PC monitor adaptor

REVIEWS:

- 2m/220 MHz mobile marvel
- Deluxe data decoder
- Smallest full-featured HT!

KENWOOD
146.520
223.620

ICOM
IC-725 HF Transceiver
PATHFINDER XL
PATHFINDER XL

HOME IS WHERE YOUR IC-725 IS

Fixed, mobile or portable, ICOM's new IC-725 delivers band-commanding performance. The easy-to-operate IC-725 reflects ICOM's world-renown excellence in circuit designs, versatility and dependability. Your enjoyment is also guaranteed with ICOM's one full year warranty!

SMALL SIZE, BIG PERFORMANCE!

Extraordinary Performance! Includes: 160 through 10 meter operation • 100 watts output • Shortwave reception from 100kHz to 33MHz • SSB, CW and AM modes (FM optional) • Sensitive 105db dynamic range receiver • Low noise DDS switching • Panel-selectable RF preamp and attenuator • Dual VFO's • Selectable AGC • Rugged full duty cycle finals.

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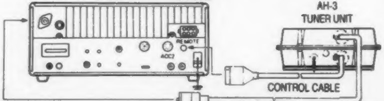
Full Featured Operation! 26 tunable memories with Band Stacking Registers which enable you to store a frequency, switch bands, and return to the stored frequency • 10Hz digital frequency display • Three tuning rates • Three scan modes • Highly effective Noise Blanker • RIT • Semi-QSK CW • Optional narrow CW filter • Built-in AH-3 controller • IC-725 measures only 9.0 x 3.7 x 9.4 inches (H, W, D).

Optional AH-3 automatic and remote antenna tuner for mobile and portable operation. Plugs directly into the IC-725. Wide impedance matching range. Mating whip unit (AH2-B) bolts to auto's frame, works 80-10 meters.


IC-725
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ACC2
AH-3
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CIRCLE 354 ON READER SERVICE CARD

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M.SCAN
M▸VFO
MEMO
M W
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ICOM
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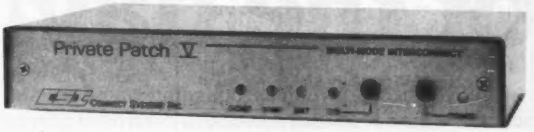
SSB
CW/N
AM/FM
kHz
MHz
BAND
LOCK
FM TONE
RIT
TUNER
FUNC
THROUGH
PHONES
MIC
NB
ATT
PRE
AGC

LOOKING FOR AN AUTOPATCH OR REPEATER CONTROLLER?

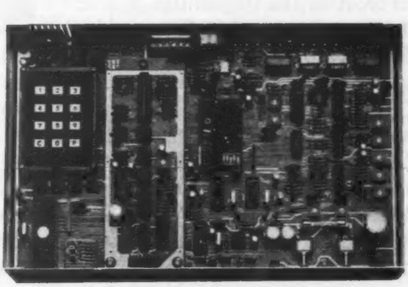
	PRIVATE PATCH V	510SA-II	510SA
Auto-dialer	90 phone numbers	None	None
Last number redial	Yes	No	No
Hook flash	Yes	No	No
Programming keyboard	Built-in	Plug-in	None
Programming digital display	Yes	No	No
Noise filter	5 pole	2 pole	2 pole
Regenerated DTMF dialing	Yes	No	No
DTMF decode LED	Yes	No	No
Selectable VOX simplex, sampling simplex, duplex and repeater controller operating modes	Yes	No	No
Number of keyboard selectable sampling mode VOX enhancement ratios	8	2	None
Operates through repeaters	Yes	No	No
Method of connection to base radio	Internal or External	Internal Only	Internal Only
CPU program memory	8k	2k	2k
Busy signal disconnect	Yes	No	No
Dialtone disconnect	Yes	No	No
Selectable three digit repeater mode on/off code	Yes	No	No
Remotely controllable internal aux relay	Yes	No	No
Optional CTCSS board available	Yes	No	No
Optional voice delay board available	Yes	No	No
Warranty	1 Year	6 Mo.	6 Mo.

When you compare Private Patch V to the competition, the choice is clear!



ADDITIONAL FEATURES

- **USER PROGRAMMABLE CW ID**
- **DIAL ANY PRE-SELECTED NUMBER BY PRESSING THE MIC BUTTON FIVE TIMES.**
- **COMPLETE PATCH STATUS BEEPS**
- **FRONT PANEL STATUS LEDS**
- **HALF DUPLEX PRIVACY MODE** (with beeps)
- **SELECTABLE CONNECT CODE 1-5 DIGITS**
- **SELECTABLE TOLL OVERRIDE CODE 2-5 DIGITS**
- **SELECTABLE DISCONNECT CODE 1-5 DIGITS**
- **SELECTABLE TOLL RESTRICTION:**
  - ✓ First digit lockout
  - ✓ Prefix lockout
  - ✓ Digit counting
- **SELECTABLE ACTIVITY/TIMEOUT TIMERS**
- **RINGOUT**
  (Receive your calls in the mobile)
- **RING COUNTING**
  (Ringout alerts after pre-selected no. of rings)
- **REMOTE BASE**
  (Use your base radio from any telephone)
- **LAND TO MOBILE SELECTIVE CALLING**
- **INTERNALLY SQUELCHED AUDIO**
- **MOV LIGHTING PROTECTORS**
- **SELECTABLE TONE OR PULSE DIALING**



Note built-in programming keyboard and digital display just above keyboard.

CSI CONNECT SYSTEMS INC.

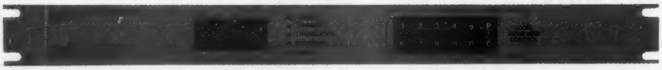
2064 Eastman Ave. #113 • Ventura, CA 93003
Phone (805) 642-7184 • FAX (805) 642-7271

CIRCLE 12 ON READER SERVICE CARD

Catch of the day!

Have you been trawling the bounding main for a new product? We have just netted it—the TP-38 microprocessor controlled community repeater panel which provides the complete interface between the repeater receiver and transmitter. Scuttle individual tone cards, all 38 EIA standard CTCSS tones are included as well as time and hit accumulators, programmable timers, tone translation, and AC power supply at one low price of $595.00. The TP-38 is packed like a can of sardines with features, as a matter of fact the only additional option is a DTMF module for $59.95. This module allows complete offsite remote control of all TP-38 functions, including adding new customers or deleting poor paying ones, over the repeater receiver channel.

Other features include CMOS circuitry for low power consumption, non-volatile memory to retain programming if power loss occurs, immunity to falsing, programmable security code and much more. The TP-38 is backed by our legendary 1 year warranty and is shipped fresh daily. Why not set passage for the abundant waters of Communications Specialists and cast your nets for a TP-38 or other fine catch.



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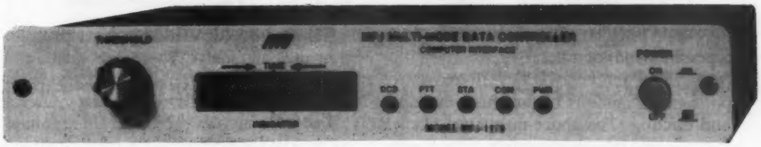
CIRCLE 10 ON READER SERVICE CARD

MFJ multi-mode data controller



9 modes for only . . . $249.95

Amateur radio's most versatile multi-mode data controller - the MFJ-1278 -lets you join the fun on Packet, AMTOR, RTTY, ASCII, CW, Weather FAX, SSTV, Navtex and gives you a full featured Contest Memory Keyer mode . . . you get 9 modes . . . for an affordable $249.95.

Plus you get MFJ's new **Easy Mail™** Personal Mailbox so you and your ham buddies can leave messages for each other 24 hours a day.

You'll find it **the most user friendly of all multi-modes.** It's menu driven for ease of use **and** command driven for speed.

A high resolution 20 LED tuning indicator lets you *tune in signals **fast** in any mode.* All you have to do is to center a single LED and *you're precisely tuned in to within 10 Hz* -- and it shows you which way to tune!

Plus you get 32K RAM, KISS for TCP/IP, high performance HF/VHF/CW modems, software selectable dual radio ports, AC power supply and more.

All you need to join the fun is an MFJ-1278, your rig and any computer with a serial port and terminal program.

You can use the MFJ Starter Pack to get on the air instantly. It includes computer interfacing cable, terminal software and friendly instructions ... everything you need. Order MFJ-1282 (disk)/ MFJ-1283 (tape) for C-64/128/VIC-20; MFJ-1284 the IBM or compatible; MFJ-1287 for Macintosh, $24.95 each.

Packet

MFJ's new generation packet mode gives you genuine TAPR software and hardware plus many MFJ enhancments like the Easy Mail™ Personal Mailbox.

A new KISS interface makes the MFJ-1278 TCP/IP compatible.

Extensive tests published in *Packet Radio Magazine* ("HF Modem Performance Comparisons") prove the TAPR designed modem in the MFJ-1278 gives better copy with proper DCD operation under all tested conditions than the other modems tested.

New AMTOR mode!

Now MFJ-1278 has a new AMTOR mode, making it the only controller to feature **nine** digital modes.

MFJ-1278 transmits and receives AMTOR and includes all AMTOR modes: ARQ (Mode A), FEC and MODE S (Mode B).

Baudot RTTY

You can copy all shifts and all standard speeds including 170, 425 and 800 Hz shifts and speeds from 45 to 300 baud. *You can copy not only amateur RTTY but also press, weather and other exciting traffic.*

You can transmit both narrow and wide shifts. The wide shift is a standard 850 Hz shift with mark/space tones of 2125/2975 Hz. This lets you operate MARS and standard VHF FM RTTY.

ASCII

You can transmit and receive 7 bit ASCII using the same shifts and speeds as in the RTTY mode.

CW

You get a Super Morse Keyboard mode that lets you send and receive CW effortlessly, including all prosigns -- it's tailor-made for traffic handlers.

A huge type ahead buffer lets you send smooth CW even if you "hunt and peck".

You could store entire QSOs in the message memories, if you wanted to! You can link and repeat any messages for automatic CQs and beaconing. Memories also work in RTTY and ASCII modes.

***A** tone Modulated CW mode turns your VHF FM rig into a CW transceiver* for a new fun mode. It's perfect for transmitting code practice over VHF FM.

An AFSK CW mode lets you ID in CW.

You also get a random code generator that'll help you copy CW faster.

Weather FAX

You'll be fascinated as you watch WEFAX signals blossom into full fledged weather maps on your Epson or IBM graphics compatible printer.

Automatic sync and stop lets you set it and leave it for no hassle printing.

You can save FAX pictures and WEFAX maps to disk if your terminal program lets you save ASCII files to disk.

Pictures and maps can be saved to disk or *printed to screen in real time or from disk if you have an IBM or Macintosh* with the MFJ Starter Pack.

You can transmit FAX pictures right off disk and have fun exchanging and collecting them.

Slow Scan TV

The MFJ-1278 introduces you to the exciting world of slow scan TV.

You can print slow scan TV pictures on any IBM or Epson graphics compatible printer. If you have an IBM or Macintosh you can print to screen and save to disk with the MFJ Starter Pack.

You can transmit slow scan pictures right off disk. If your terminal program lets you save ASCII files you can save pictures from over-the-air QSOs.

You can transmit and receive 8.5, 12, 17, 24, and 36 second black and white format SSTV pictures using two levels.

Contest Memory Keyer

***Nothing** beats the quick response of a memory keyer during a heated contest.*

You'll score valuable contest points by completing QSOs so fast you'll leave your competition behind. And you can snag rare DX by slipping in so quickly you'll catch everyone by surprise.

Message memories let you store contest call, name, QTH, rig info -- everything you used to repeat over and over.

You get iambic operation, automatic incrementing serial numbering, weight control to penetrate QRM and more.

More Features

Turn on your MFJ-1278 and it sets itself to match your computer baud rate. Select your operating mode and the correct modem is automatically selected.

Plus . . . printing in all modes, threshold control for varying band conditions, tune-up command, lithium battery backup, RS-232 and TTL level serial ports, watch dog timer, FSK and AFSK outputs, output level control, speaker jack, key paddle jack, test and calibration software, Z-80 at 4.9 MHz, 32K EPROM, and socketed ICs. FCC approved. 9x1½x9½ in. 12 VDC or 110 VAC.

Get yours today and join the fun crowd!

New Firmware Update

A new KISS/AMTOR/Navtex Firmware update is available to MFJ-1278 owners.

MFJ's powerful update is the most reasonably priced mulit-mode upgrade by any manufacturer. Contact your dealer or MFJ for yours today!

MFJ Packet Radio

MFJ-1274
$149⁹⁵

MFJ-1270B
$129⁹⁵

MFJ-1270B super clone of TAPR's TNC-2 give you more features than *any* other packet controller -- for **$129.95.**

You can double your fun by operating both VHF *and* HF packet because you get **high performance** switchable VHF/HF modems.

You get the **Easy Mail™** Personal Mailbox with soft-partitioned memory so you and your ham buddies can leave messages for each other 24 hours a day.

In MFJ's new WeFAX mode you can print full fledged weather maps to screen or printer and save to disk using an IBM compatible or Macintosh computer with an MFJ Starter Pack.

A new **KISS** interface lets you run **TCP/IP.** They also come **NET ROM** compatible -- ***no modification needed!***

You also get 32K RAM, a one-year *unconditional* guarantee and you can use 12 VDC or the included 110 VAC power supply.

For dependable HF packet tuning, the **MFJ-1274** gives you a high resolution tuning indicator that's accurate to within 10 Hz -- and it's only **$20.00** more. Add $5 each shipping/handling.

MFJ

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CIRCLE 24 ON READER SERVICE CARD

Number 1 on your Feedback card

Welcome, Newcomers!

VHF-AND-ABOVE ANTENNAS

VHF is not just a name for the band of TV channels from 2 to 13. It means Very High Frequency, and it applies to that band of frequencies from 30 MHz to 300 MHz. Of course, the frequencies for TV channels 2–13 are contained in this range, as well as many other services. The amateur radio service has three VHF bands, and many bands above VHF. The next segment of the spectrum above VHF is UHF (300–1000 MHz), and above that, the microwave bands (1000–300,000 MHz).

73 Magazine has in the past devoted issues to antennas covering the whole **radio frequency spectrum.** The subject of antennas has become so broad, however, that we can't begin to do justice to its entirety in a single issue. Therefore, this issue focusses on VHF-and-above antennas, and the September issue will focus on antennas for 30 MHz and below.

From Heah to Theah

Why divide the spectrum at 30 MHz? The reason is that **propagation** characteristics change radically at this point. The **ionosphere** refracts waves below 30 MHz back to Earth, which in turn refracts the waves back to the ionosphere. Waves often travel around the Earth in this vertical zig-zag pattern. It is this kind of propagation—**sky wave** propagation—which allows us to hear transcontinental shortwave stations, and distant AM stations at night.

Waves above 30 MHz pierce the ionosphere and zip out into the Cosmos. Unsuspecting alien societies in different solar systems may hear all about a VHFer's new rig or the latest Star Trek film. Earth-bound VHFers, however, have to hear about it via the **tropospheric wave**. This wave is useful only when there is a direct clear path between the transmitter and receiver. This is the kind of propagation used for television, or between a ham's mobile transmitter and a **repeater**. Normally, only line-of-sight tropo propagation is available to VHF-and-above enthusiasts.

However...

One late spring night I was watching Channel 5 on TV, which normally receives a Boston station located about 80 miles away from my home. All of a sudden, I was hearing (though not seeing well) strictly Canadian news. After a few minutes, the TV station identified its location as Ottawa—over 300 miles away! For a brief period, its signal overrode the Boston station located only a quarter of the distance away. How could this happen?

We chose this month for VHF-and-above antennas for a very good reason. The spring and summer in the Northern Hemisphere, with all its active weather, creates conditions which allow VHF-and-above tropo waves to propagate well beyond line-of-sight—sometimes thousands of miles!

The most common **DX** VHF-and-above propagation mode is **tropospheric bending and ducting.** The above-mentioned Ottawa station came into southwestern New Hampshire through a tropo duct. Another useful mode is **sporadic E**.

There are other DX VHF-and-above propagation modes which occur throughout the year, but the two above produce the most spectacular DX with even a relatively simple station set-up.

Go Forth and Propagate

Fascinated with VHF-and-above propagation and antennas? There are many fine sources of information on this, several of which are in *73*. Arliss Thompson's "Aerial View" column is an excellent monthly antenna tutorial for beginners. Chuck Houghton's "Above and Beyond" column discusses the latest happenings in the world of VHF and above, and it's ideal for those beyond the beginner level. And, of course, there's *The ARRL Antenna Handbook.*

Hope to see you on VHF-and-above DX! ...de NS1B

GLOSSARY

Radio Frequency Spectrum—The portion of the electromagnetic wave spectrum with wavelengths ranging from 30 kilometers to 1 millimeter. The corresponding frequencies are 10,000 cycles/second (10 kHz) to 3000 billion cycles/second (3000 GHz).

Propagation—The transfer of energy through a medium, such as the atmosphere, or space.

Ionosphere—An upper-atmosphere layer, ranging 75–200 miles above the Earth's surface. So called because molecules at that level are ionized (i.e., they lose electrons) by solar rays passing through them.

Sky Wave—A radio wave that travels up to, and is refracted back to Earth by, the ionosphere. A single-skip sky wave—one that is refracted just once by the ionosphere—can travel up to several thousand terrestrial miles. They are mainly responsible for worldwide radio communications.

Tropospheric Wave—A wave that travels through the troposphere, the lower part of the atmosphere that extends up six miles from the Earth's surface, by reflection.

Repeater—A machine that receives a signal and simultaneously retransmits it on a different frequency. They are normally used to extend the range of line-of-sight signals. They are very popular for mobile-to-mobile VHF-and-above communications.

DX—"Long Distance." The distance that qualifies as DX varies from band to band. VHF-and-above DX are distances well beyond the range of line-of-sight.

Tropospheric bending and ducting—The condition in which radio waves are refracted when passing through two layers in the troposphere that have sharply contrasting temperatures and moisture content. A duct is formed by a layer of moist cool air over warm dry air, which in turn sits on the Earth. Since the wave is refracted both by the moist, cool air layer, and by the Earth, the warm dry air layer acts as the duct, or waveguide. Waves of up to 10,000 MHz have travelled hundreds of miles by ducting. Ducted VHF waves have been detected from several thousand miles away!

Sporadic E—This is propagation whereby sky waves are refracted by dense patches of ions in the E-layer of the ionosphere. Waves up to 430 MHz are known to have been propagated via sporadic E. Since this layer is in the lower ionosphere, wave skip distances are shorter (typically 400–1300 miles). This is also known as "short skip."

QRM

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Binding Contract: See where natural ham curiosity gets you? Upon finishing reading the first sentence, you have formally contracted with *73 Magazine* to be our grass-roots ad sales person. Recognizing that we give you more ham fun for the buck than the rest, it should be a cinch to make this clear to every dealer and manufacturer you contact to exhort them to advertise with us. Remember: More ad pages = more articles.

So where does ham curiosity lead to?—more great home-brew for you!

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It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

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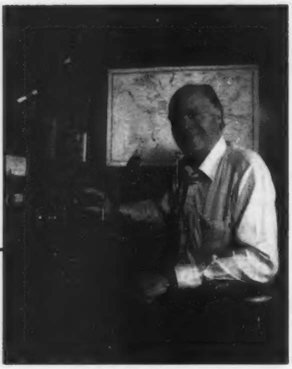
Cover: Kenwood's 2m/220 MHz mobile rig and Procomm's wide-band discone antenna.

Dayton action—be there in '89!

Number 2 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1



Did the 220 MHz Loss Get Your Attention?

Judging from some recent letters, the August loss of 40% of the 220 MHz band actually managed to get the attention of some old-timers. Good grief, is it possible that Wayne may be right?

Yes, I warned you that unless we made some substantial changes, the FCC was going to start whittling down our ham bands. I also mentioned that, once we lose a ham band, we aren't ever going to get it back.

If we'd gone to the FCC with a realistic plan for the use and development of 220, I think we might have been able to hold on to it. But the FCC is well aware of the drop in new licensees and the age of the average ham, so they took the practical approach. It was us or UPS, and UPS had more political clout.

So, what can we do?

Well, if we want to stop the blood-letting, we've got to get some growth. We need to figure out how to attract youngsters, or we're dead.

The Joy of Building

One thing we haven't tried yet is to get youngsters interested in amateur radio for the same reasons we did when we were young: building. I've been writing in my editorials for several years asking you to build small home construction projects and write 'em up so I can publish them in *73*. That's why I started *73* in the first place 28 years ago.

One of the reasons I got fired from *CQ* had to do with my insisting on publishing construction projects. The publisher wanted to publish just monthly columns. Much cheaper. So when I was fired as editor and decided to start *73*, my basic idea was to publish as many construction projects as I could. And I did.

It's more difficult today, I grant you. When I started *73* back in 1960, there were over 850 ham radio stores, all carrying parts. Most of them had long counters of parts bargains, so we all loaded up with everything we thought we'd need. I had drawers full of resistors, more drawers of capacitors, cartons of tubes, sockets, connectors, jacks, terminal strips, boxes of chassis and panels—plus a machine shop with a metal brake, a drill press, and a metal punch . . . and I used 'em.

I had cartons of variables pots, coils, coil wire, high voltage wire, power transformers, audio transformers. When I moved to New Hampshire in 1962, it took four large truck loads to move all my stuff up here. I'd been stocking up on parts for 25 years, and you wouldn't believe my junk box. Hams used to bring their wives to see my Brooklyn cellar workshop and say, "And you thought my ham shack was a mess!" I had four garages full of ham equipment and parts.

I had surplus by the ton. Transmitters, test equipment, Teletypes, receivers, transceivers. As for parts, if I found a bargain, I'd buy a dozen just in case. I had cartons of toggle switches, microswitches, push-button switches, slide switches, and relays of every kind from microminiature to high power kluges.

Getting Parts for Building

Alas, the same 1963 Incentive Licensing fire storm that killed off the growth of amateur radio—and that killed about 90% of the ham dealers and 99% of the manufacturers—also virtually wiped out our parts suppliers. Today you have a choice of a few odds and ends from Radio Shack or some mail order houses, such as Ramsey, and some surplus houses, such as Meshna. You don't just go out and buy parts any more.

With the loss of our consumer electronic industry to Japan, the need for parts to be made in the US has almost disappeared. Today most of the parts we see are imported from Japan. American defense contractors who have to use American-made parts are forced in many cases to use virtually custom-made parts, even for simple items such as one-Watt resistors. This increases the cost from about a half cent to a couple of dollars each. Such are the insanities of military contracts. We're blowing millions on such crazy things.

You've read about the Akihabara section of Tokyo where there are hundreds of small shops selling electronic parts. The Japanese youngsters throng to Akihabara by the thousands to buy parts so they can build. The Japanese ham magazines have a wealth of interesting construction projects, which may be one of the reasons why there are so many young Japanese hams.

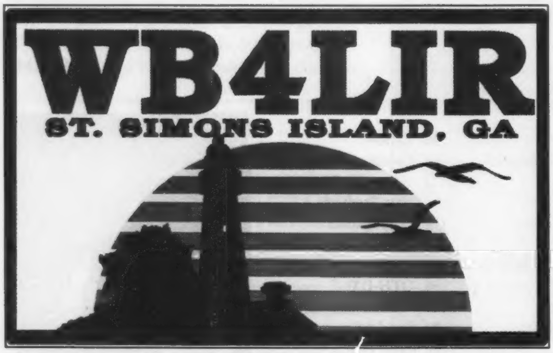
About the last bastion for ham parts in America are at hamfests such as Dayton. There you'll find the long counters piled high with parts—just about anything you could want. There were some in Atlanta, but Dayton is King.

Now I realize that getting parts is difficult, but I also know that if you want to get them badly enough, you'll find a way. What do you need parts for? I want you to get busy and start building small construction projects and writing 'em up so I can publish them in *73* and help us get youngsters into building.

You have time to write. Yes, you need some relaxation, but the average family watches TV 7.5 hours a day. We're not talking relaxation here, we're talking wasted lives. It's no wonder our kids have no concept of working or achievement. Look at the examples we're setting for them!

If you'd get at it, you could whip up at least one construction project a month. I'd not only pack *73* with them, I'd start getting ads for parts. Some entrepreneurs would start importing parts from Japan and we'd have more parts to work with. Who knows, we might eventually get kids into building and end up with enough engineers and technicians to get back some consumer electronic manufacturing. The next thing you know, we'd start seeing some parts being made in America again. If I get too many construction

continued on p. 90



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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DX-cellence!

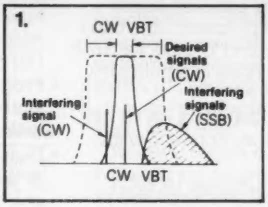
TS-940S

Competition class HF transceiver

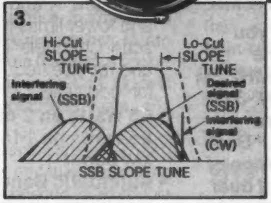
TS-940S—the standard of performance by which all other transceivers are judged. Pushing the state-of-the-art in HF transceiver design and construction, no one has been able to match the TS-940S in performance, value and reliability. The product reviews glow with superlatives, and the field-proven performance shows that the TS-940S is "The Number One Rated HF Transceiver!"

- **100% duty cycle transmitter.** Kenwood specifies transmit duty cycle ***time.*** The TS-940S is guaranteed to operate at full power output for periods ***exceeding one hour.*** (14.250 MHz, CW, 110 watts.) Perfect for RTTY, SSTV, and other long-duration modes.
- **First with a full one-year limited warranty.**
- **Extremely stable phase locked loop (PLL) VFO.** Reference frequency accuracy is measured in ***parts per million!***

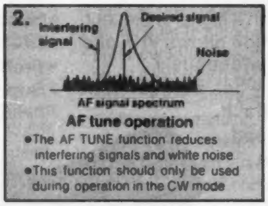
1.


CW VBT
Desired signals (CW)
Interfering signals (SSB)
Interfering signal (CW)
CW VBT

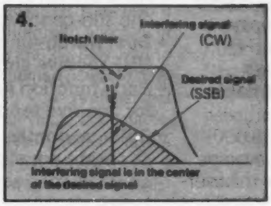
3.


Hi-Cut SLOPE TUNE
Lo-Cut SLOPE TUNE
Interfering signal (SSB)
Desired signal (SSB)
Interfering signal (CW)
SSB SLOPE TUNE

2.


Interfering signal
Desired signal
Noise
AF signal spectrum
AF tune operation
•The AF TUNE function reduces interfering signals and white noise
•This function should only be used during operation in the CW mode

4.


Notch filter
Interfering signal (CW)
Desired signal (SSB)
Interfering signal is in the center of the desired signal

1) CW Variable Bandwidth Tuning. Vary the passband width continuously in the CW, FSK, and AM modes, without affecting the center frequency. This effectively minimizes QRM from nearby SSB and CW signals.

2) AF Tune. Enabled with the push of a button, this CW interference fighter inserts a tunable, three pole active filter between the SSB/CW demodulator and the audio amplifier. During CW QSOs, this control can be used to reduce interfering signals and noise, and peaks audio frequency response for optimum CW performance.

3) SSB Slope Tuning. Operating in the LSB and USB modes, this front panel control allows independent, continuously variable adjustment of the high or low frequency slopes of the IF passband. The LCD sub display illustrates the filtering position.

4) IF Notch Filter. The tunable notch filter sharply attenuates interfering signals by as much as 40 dB. As shown here, the interfering signal is reduced, while the desired signal remains unaffected. The notch filter works in all modes except FM.

- **Complete all band, all mode transceiver with general coverage receiver.** Receiver covers 150 kHz-30 MHz. All modes built-in: AM, FM, CW, FSK, LSB, USB.
- **Superb, human engineered front panel layout for the DX-minded or contesting ham.** Large fluorescent tube main display with dimmer; direct keyboard input of frequency; flywheel type main tuning knob with optical encoder mechanism all combine to make the TS-940S a joy to operate.
- **One-touch frequency check (T-F SET) during split operations.**
- **Unique LCD sub display indicates VFO, graphic indication of VBT and SSB Slope tuning, and time.**
- **Simple one step mode changing with CW announcement.**
- **Other vital operating functions.** Selectable semi or full break-in CW (QSK), RIT/XIT, all mode squelch, RF attenuator, filter select switch, selectable AGC, CW variable pitch control, speech processor, and RF power output control, programmable band scan or 40 channel memory scan.

Optional accessories:
• AT-940 full range (160-10m) automatic antenna tuner • SP-940 external speaker with audio filtering • YG-455C-1 (500 Hz), YG-455CN-1 (250 Hz), YK-88C-1 (500 Hz) CW filters; YK-88A-1 (6 kHz) AM filter • VS-1 voice synthesizer • SO-1 temperature compensated crystal oscillator • MC-43S UP/DOWN hand mic. • MC-60A, MC-80, MC-85 deluxe base station mics. • PC-1A phone patch • TL-922A linear amplifier • SM-220 station monitor • BS-8 pan display • SW-200A and SW-2000 SWR and power meters • IF-232C/IF-10B computer interface.

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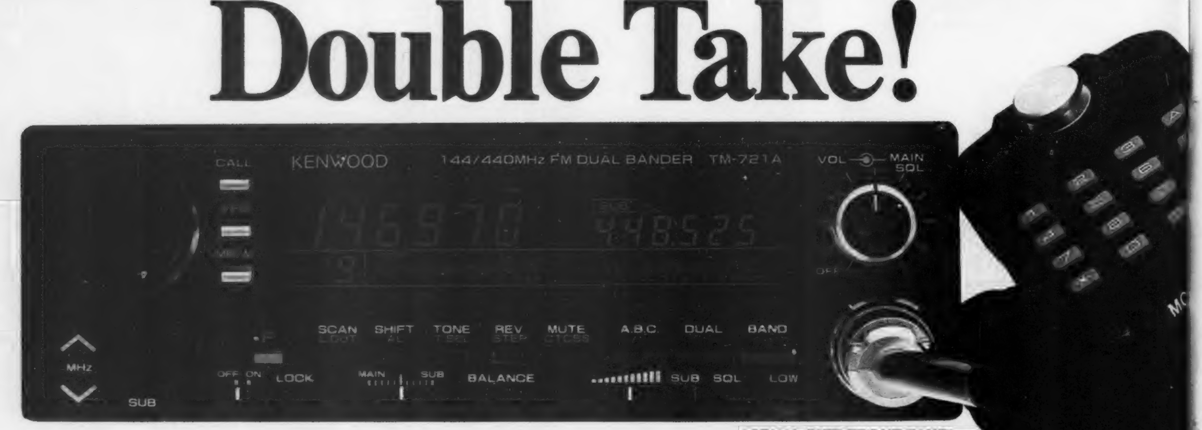
THE FIRST 144/220 MHz Dual Bander!

Double Take!



ACTUAL SIZE FRONT PANEL

TM-621A/721A

144/220 and 144/450 MHz FM Dual Banders

Once again, Kenwood brings you another Dual Bander First! The TM-621A is the first 144/220 MHz FM Dual Bander. The Kenwood TM-621A and TM-721A (144/450 MHz) re-defines the original Kenwood "Dual Bander" concept. The wide range of innovative features includes a dual channel watch function, selectable full duplex operation, 30 memory channels, extended frequency coverage, large multi-color dual digital LCD displays, programmable scanning, and more!

- **Extended receiver range** (138.000-173.995 MHz) on 2 m; 70 cm coverage is 438.000-449.995 MHz; 1-1/4 m coverage is 215-229.995 MHz. (Specifications guaranteed on Amateur bands only. Two meter transmit range is 144-148 MHz. Modifiable for MARS/CAP. Permits required.)
- **Separate frequency display for "main" and "sub-band."**
- **Call channel function.** A special memory channel for each band stores frequency, offset, and sub-tone of your favorite channel. Simply press the CALL key, and your favorite channel is selected!
- **30 multi-function memory channels.** 14 memory channels and one call channel for each band store frequency, repeater offset, CTCSS, and reverse. Channels "A" and "b" establish upper and lower limits for programmable band scan. Channels "C" and "d" store transmit and receive frequencies independently for "odd splits."
- **45 Watts on 2 m, 35 watts on 70 cm. 25 watts on 1-1/4 m.** Approx. 5 watts low power.
- **Automatic Band Change (A.B.C.)** Automatically changes between main and sub-band when a signal is present.
- **Dual watch function allows VHF and UHF receive simultaneously.**
- **Each function key has a unique tone for positive feedback.**
- **Balance control and separate squelch controls for each band.**
- **Dual antenna ports.**
- **TM-621A has auto offset.**
- **Full duplex operation.**
- **CTCSS encode/decode selectable from front panel** or UP/DWN keys on microphone. (Encode built-in, optional TSU-6 needed for decode.)
- **Programmable memory and band scanning, with memory channel lock-out and priority watch function.**
- **Illuminated front panel controls and keys.**
- **16 key DTMF mic. included.**
- **Handset/remote control option (RC-10).**
- **Frequency (dial) lock.**
- **Supplied accessories:** 16-key DTMF hand mic., mounting bracket, DC cable.

TM-721A shown with optional RC-10.

Optional Accessories:
• **RC-10** Multi-function handset/remote controller • **PS-430** Power supply • **TSU-6** CTCSS decode unit • **SW-100B** Compact SWR/power/volt meter • **SW-200B** Deluxe SWR/power meter • **SWT-1** 2m antenna tuner • **SWT-2** 70 cm antenna tuner • **SP-40** Compact mobile speaker • **SP-50B** Deluxe mobile speaker • **PG-2N** DC cable • **PG-3B** DC line noise filter • **MC-60A, MC-80, MC-85** Base station mics. • **MA-700** Dual band (2 m/70 cm) mobile antenna (mount not supplied) • **MB-11** Mobile bracket • **MC-43S** UP/DWN hand mic. • **MC-48B** 16-key DTMF hand mic.

Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications, features and prices are subject to change without notice or obligation.

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Number 3 on your Feedback card

QRX . . .

EDITED BY BRYAN HASTINGS NS1B

Home-brew Contest Deadline

You haven't yet gotten around to writing up your home-brew project to submit to our *Home-brew IV* contest? Now you have a reprieve—we have moved forward the deadline for article submissions for this contest by three months. Please note that the new deadline is July 1, 1989. (See announcement in box.) Ham fame and fortune still await you—but only for a few more months!

Atlas Radio Busted!

On January 26 1989, Postal Inspector Martin Biegelman arrested Michael J. Harrison, 36, at his residence of 431 Windsor Place, Oceanside, New York. Harrison was charged with mail fraud and wire fraud. He was arraigned in US District Court, Eastern District of NY, Brooklyn NY on January 26th 1989 before US Magistrate Allyne Ross. Harrison was released on a $25,000 Personal Recognizance Bond.

Victims of this fraud should contact Martin Biegelman via letter and include the following information: magazine issue of advertisement appearance, product order date, product(s) ordered, copy of front or back of check or money order sent, form of US mail used, whether or not the person received what was ordered, what representations or misrepresentations were made by Michael Harrison and/or any other person from Atlas/Dentron, etc., what efforts were made by the victim to contact Harrison, and Harrison's response(s), and any other pertinent facts. Please send this info, including copies of advertisements, letters, receipts, etc., to *Martin Biegelman, Postal Inspector, PO Box 160, Hicksville NY 11802-0160.*

Mail fraud and wire fraud each carries a five-year prison sentence and a $250,000 fine.

Looking West

Bill Pasternak WA6ITF's Looking West FM column has gone bi-monthly. Bill has agreed to become our primary QRX news supplier using the facilities of the worldwide Westlink all-volunteer organization.

U4MIR Comes To Life

Stations around the world have been reporting hearing and working U4MIR. According to Hans ZS6AKV, stations in southern Africa worked the new *Mir* station as early as Thursday, February 9. Since then, stations in Britain, Eastern Canada, and Europe have reported contacts.

Alex has made most of the contacts on 145.550 MHz simplex, and a few on 145.650 MHz simplex. Alex has kept the same operating hours as Musa U2MIR—1900 UTC and later, in the period between the cosmonauts' dinner hour and lights-out. *Mir*'s operations schedule is on Moscow time, which is three hours ahead of UTC.

Bill VE3EFX reports that the new operator's name is Alexander, or "Sasha." His English is poor and he seems to have trouble with callsigns—please speak slowly and distinctly, and stick to standard ICAO phonetics.

Pat G3IOR reports that a new crew will go up in April, and is now receiving amateur radio instruction. Continue to QSL via Boris Stepanov UW3AX, PO Box 679, Moscow 107207, USSR.

Nomadness Grows!

Those of you who have been reading *73* in '88 will be familiar with Steve Roberts N4RVE and his roving piece of tech-wizardry, the Winnibiko II. Steve and YL Maggie have temporarily alit in Silicon Valley while he is putting together the Winnibiko III. This new recumbent bicycle will feature, in addition to commercial communications devices to run his freelance business from the road, a packet station, HF, 2 meters, and an OSCAR Mode B setup, complete with collapsible yagis, and much, much more!

Steve and Maggie will again take to the road in the next few months—and they are looking for free spirits with the needed skills to join them in their bicycling odyssey! They plan a full-time on-the-road venture with a variety of profit centers. This may be the only way to make a living by riding a human-powered ham shack while sharpening your professional skills and expanding your range of contacts. Sound like a dream? Well. . .it is. Steve's made this dream a reality for five years.

If this strikes a chord and you want to discuss it, please write to Steve ASAP at 98 Sudbury Drive, Milpitas CA 95035. E-mail users can leave a message for Steve on GEnie. His username is WORDY.

No Code Rererevisited

Two of amateur radio's premier organizations are saying the time has come for no-code. Tucson Amateur Packet Radio (TAPR), and AMSAT North America, both issued statements that call for the creation of a code-less entry-level class of amateur license.

After careful consideration, AMSAT's Board of Directors gave its unanimous support for a code-free license for operation in the VHF and higher bands. The Board noted AMSAT's very deep concern for preserving the UHF and VHF spectrum which they feel will come under increasing attack from outside commercial interests, such as the recent case on the 1¼ meter band.

TAPR president Andy Freeborn N0CCZ and the TAPR board voted to support an amateur-initiated proposal to the FCC to provide for a no-code license class. TAPR says it recognizes the controversial nature of this issue, but that it also feels the adoption of a code-less entry-level license is critical for the future of amateur radio.

Taiwan Packet Radio

During a recent visit to Taipei, Taiwan, two US hams, Wayne Wilson WB8TSO and Denton Bramwell K7OWJ, took part in the first authorized packet radio operation from Taiwan. DU1JMG in Manila was the first station to connect. They left behind their equipment for the China Radio Association club station. Look for Tim Chen, BV2A or BV2B, on 20 meter packet radio.

903 Record?

On 27 November 1988, Dave Halliday KD5RO worked Al Ward WB5LUA on 902 MHz EME (moonbounce) from his QTH to establish a possible DX record on that band. Dave's station consisted of a 10-foot TVRO dish modified for Az-El positioning, and mounted on a single section of Rohn 25G tower. He fed this system with 220 Watts from N2WK's Hi-Spec amplifier. Al WB5LUA used a 24-foot dish fed with about 170W from a TWT amp. Terrestrial distance for the QSO: 1239 miles.

Rehab Radio Growing

Radio Time at the St. Judes Hospital station in Fullerton, California, will soon be supplemented by a mini version of Rehab Radio at the nearby Childrens Hospital of Orange County. The radio activities will be used to stimulate confined youngsters and encourage interaction. Most QSOs will be held on 2 meters for portability.

Needed are those of you willing to spend

Continued on page 11

KENWOOD
TH-25AT
144MHz

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TH-55AT 1200 MHz Here Now!

Compact Breakthrough!

TH-25AT/45AT

New Pocket Portable Transceivers

The all-new TH-25 Series of pocket transceivers is here! Wide-band frequency coverage, LCD display, 5 watt option, plus...

- Frequency coverage: **TH-25AT:** 141-163 MHz (Rx); 144-148 MHz (Tx). (Modifiable for MARS/CAP. Permits required.) **TH-45AT:** 438-450 MHz.
- Automatic Power Control (APC) circuit for reliable RF output and final protection.
- 14 memories; two for **any** "odd split" (5 kHz steps).
- Automatic offset selection (TH-25AT).
- 5 Watts from 12 VDC or PB-8 battery pack.
- Large multi-function LCD display.
- Rotary dial selects memory, frequency, CTCSS and scan direction.
- T-ALERT for quiet monitoring. Tone Alert beeps when squelch is opened.
- Band scan and memory scan.
- Automatic "power off" circuit.
- Water resistant.
- CTCSS encoder/decoder optional (TSU-6).
- **Supplied accessories:** StubbyDuk, PB-6 battery pack for 2.5 watts output, wall charger, belt hook, wrist strap, water resistant dust caps.

Optional accessories:
• **PB-5** 7.2 V, 200 mAh NiCd pack for 2.5 W output • **PB-6** 7.2 V, 600 mAh NiCd pack • **PB-7** 7.2 V, 1100 mAh NiCd pack • **PB-8** 12 V, 600 mAh NiCd for 5 W output • **PB-9** 7.2 V, 600 mAh NiCd with built-in charger • **BC-10** Compact charger • **BC-11** Rapid charger • **BT-6** AAA battery case • **DC-1/PG-2V** DC adapter • **HMC-2** Headset with VOX and PTT • **SC-14, 15, 16** Soft cases • **SMC-30/31** Speaker mics. • **TSU-6** CTCSS decode unit • **WR-1** Water resistant bag

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QRX . . .

time talking with children and QSLing them. An important part of their therapy is to prepare cards and letters to send to you in return. Those taking part will probably receive a most unusual and certainly very special QSL, but only if you take the time to send out your own card after your QSO. Anyone interested in this very worthwhile project should write to *April Moell WA6OPS, PO Box 2508, Fullerton CA 92633. [Ed Note: April Moell WA6OPS is the wife of* 73 Magazine *"Homing In" columnist Joe Moell K0OV.]*

Work In 7P-Land

Interested in working in a rare DX spot? VITA is looking for someone with both radio and computer expertise to facilitate installation of equipment both at telecom in Maseru and user sites in Maseru and rural areas, and to train system users. Interested parties should contact *Dr. Gary Garriott, 1815 N. Lynn St., Arlington VA 22209 (703) 276-1800.*

Dateline Moscow

Computer viruses are the latest of typical Western ills to hit the Soviet capital. The viruses have invaded systems in at least five government-run institutions. Sergei Abramov, a computer specialist with the USSR Academy of Sciences, told Radio Moscow the first computer virus in the Soviet Union was found last August. Authorities traced the virus source to a group of Soviet and foreign schoolchildren in a summer camp at the institute.

Private Radio Docket 88-527

The FCC has proposed a one megahertz expansion of the 6 meter repeater subbands, from 52–54, to 51–54 MHz. Due to the increasing number of repeaters in the 6 meter band, the Six Meter Club of Southern California and the Southern California Repeater and Remote Base Association (SCRRBA) filed for this regulatory change.

The FCC put forth an indefinite commentary period, to give those hams who may currently use 51–52 MHz for non-repeater operation an opportunity to preserve the present band plan.

British Polar Trek

At you read this, Lawrence G4DMA and Morag GM1ILL Howell will have left for Canada once again—to Ward Hunt Island in the beginning of March for a combination of providing communications for a British Polar expedition and a 6 meter DXpedition. This year, they have gear that will permit them to run 150 Watts on 6 meters, and they will use two rhombic antennas for the high frequency links back to the United Kingdom.

The group of scientists making the polar assault will carry British PRC-319 military man-pack radio sets with the ability to run up to 50 Watts PEP out in the 2–4 MHz range. When not in communications there, Lawrence and Morag will monitor and operate 14.345 (the European VHF Net 20 Meter Intercom), 28.885 MHz (the normal 10 meter to 6 meter crossband channel), 50.110 MHz, 144.123 plus AO-13 satellite, and other bands available to them. Their callsigns will be GM1ILL/VE8 and GM4DMA/VE8.

All their communications equipment for the trek has now been environmentally tested by partial immersion in liquid nitrogen. Lawrence and Morag will remain at the base camp to maintain a communications link with the outside world, and carry out scientific experiments. Sir Randolph Fiennes is the team leader, and the goal of the expedition is to achieve an unsupported walk of about 450 miles to the geographic North Pole by at least two people. The Howells will maintain radio contact with the walking party on various frequencies during the entire expedition. Bad weather aborted their 1988 trek attempt.

Truly Turbo

The British are working on a neural network computer, a device whose memory is organized in much the same way as a human brain. US DARPA has estimated that the human brain contains 10^{11} neurons, each having roughly 1000 dendrites, giving the brain a storage potential of 10^{14} interconnects. Since nerves fire at 100 Hz, the human brain thus has the potential to make 10^{16} interconnects per second. This is far, far greater than the CRAY XMP1-2 supercomputer with its potential of 50×10^{6} interconnects per second. It's estimated that even a fly's brain can manage some 10^{9} interconnects per second!

Just In . . .

The Soviet/US *Goodwill* HF contest will take place 9 April from 0000–2400 GMT. It is for the US and the USSR only. There are two classes: one operator all bands; and multi-operator, one transmitter. Modes and bands: SSB, CW, and mixed on 10, 15, and 20 meters. US hams should call "CQU." US exchanges should include QSO number plus the state. One QSO equals one point—no multipliers. You can work the same station on different bands.

See *CQ Magazine* and the *DX Bulletin* for further info.

Thanks

To all who contributed to this month's QRX column. They are *Westlink, Indianapolis Star News, Worldradio, G8AUU, AMSAT-NA, Art Unwin KB9MZ, KD5RO, N6BVU, K5ZMS, G3VA, NT2X, and W2RS (via N6VV 10m packet). Keep your news items and photos rolling in to* 70 Rt 202 N, Peterborough, NH 03459-1194, Attn: QRX

$$ HOME-BREW IV $$

73 Magazine again invites all home-brewers to turn their hot solder into cold cash and prizes, and to get their name in print to boot. All projects have a chance to appear in the magazine, and we will handsomely reward the authors of the best of these.

Now for the bounty. Ramsey Electronics sweetened the pot from their line of frequency counters. First prize is $300, a 10-year subscription to *73*, and a CT-125 1.25 GHz frequency counter. Second prize is $150, a two-year sub, and a CT-90 600 MHz frequency counter. Third prize is $75, a two-year sub, and a CT-70 525 MHz frequency counter. All this is in addition to the payment every author receives for publishing in *73*.

Contest Rules

1. Entries must be received by 1 July 1989.
2. To enter, write an article describing your best home-brew construction project and submit it to *73*. If you've never written for *73*, send an SASE for a copy of our Writer's Guide, or download it from CompuServe (Hamnet forum, Library 0., filename "73WRIT"). *Be sure to state on the submission that it is for the Home-brew IV contest.*
3. Here's the real challenge: The total cost of your project must be under $73, even if all the parts were bought new. Be sure to include a detailed parts list with prices and sources.
4. Our technical staff will evaluate each project on the basis of originality, usefulness, reproducibility, economy of design, and clarity of presentation. The decision of the judges is final.
5. All projects must be original. That is, they must not be published elsewhere. There is no limit to the number of projects you may enter.
6. All purchased articles become the property of *73 Magazine*.
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Attn: Home-Brew IV

Powerful Crystal Set

A "something for nothing" radio.

by Pete Haas

This crystal set has several improvements on a classic design. The speaker volume, though not ear-shattering, is plenty loud. The cumulative effects of several "tweaks" will allow the set to drive a speaker. Here's a description of each improvement.

Ferrite Tuning Coils: I used a ferrite bar instead of larger air-core coils, because the bar has a much higher Q. The main tank circuit coil is wound on a flat ferrite bar. More iron surface area is exposed compared to a round slug and fewer turns of wire are needed. In general, the fewer turns of wire needed in a tank circuit, the higher the quality will be. A junked AM pocket radio is a good source for a ferrite bar. The exact dimensions of the bar aren't critical. Just find one that's close to the one described here. The coil has multiple taps so you will have some leeway.

Antenna Matcher: The use of an antenna matcher is essential, since the characteristics of long wire antennas vary according to many factors. The big factor is antenna length, but height above the ground, gauge of wire, resistance in the actual antenna connections, moisture content of the air, and solid ground connection, all also figure into the picture. (Yes, a crystal set will work without an earth ground, but try it with and without. There's an increase in volume with the use of a good earth ground.) The matcher here is simply a loopstick and a variable capacitor in the 250–365pF range. It markedly increases the crystal set's efficiency and allows just about any length of wire to be used as an antenna. If you have an outdoor CB or scanner antenna with a long coax run of 50 feet or more, you can use the coax as a long wire antenna by attaching it with a clip lead to the crystal set. Just be sure to *temporarily* disconnect the shield from its earth ground.

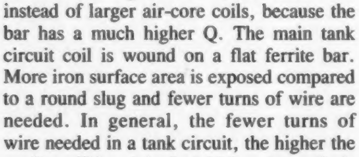

Figure 1. Hand-winding of the ferrite tuning coil.

> ***". . . several 'tweaks' will allow the set to drive a speaker."***

Voltage Doubler Detector: The voltage doubler produced slightly louder volume over a full-wave bridge rectifier. Technically, it's still a half-wave rectifier, but the circuit configuration uses both halves of the RF wave to charge two capacitors which fire off in series to produce twice the voltage—just like batteries do when placed in series. The voltage doubler increases volume before going through an audio step-down transformer.

Walkman Type Loudspeakers: These are passive but highly efficient loudspeakers that plug into the cassette player's headphone jack. The speakers have small powerful samarium cobalt magnets, and cones made of thin, very lightweight plastic such as Mylar. They don't rate well as hi-fi producers but they are capable of fairly loud volume with only a few milliwatts of drive.

Dual Tuning Circuit: Since two tank circuits are used, the received radio signal will have twice the current as compared to a conventional crystal set.

Selectivity Switch: This crystal set has a choice of wide or narrow selectivity. Adding a tap to L1 effectively reduces the number of turns, increasing the Q, and in turn the set's selectivity. If you want to tune in a weak radio signal that's right next to a powerful signal, the narrow position will help a lot. For maximum sensitivity and general bandscanning, use the wide position.

Construction

Dual 365 pF variables are hard to find, so I used two separate ones. There's a slight

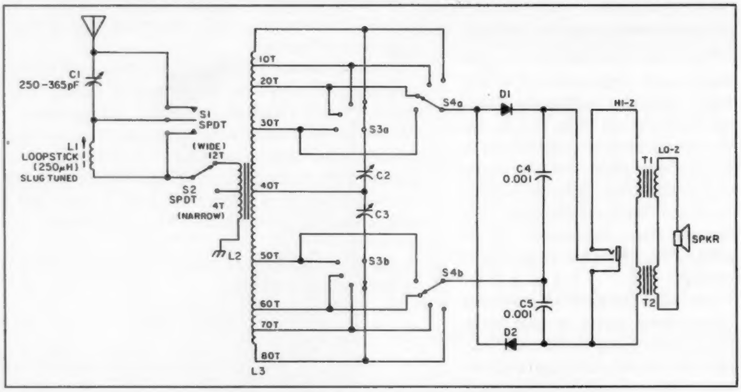

Figure 2. Schematic of the crystal set.

advantage to this. When you have a radio station tuned in for the loudest signal you may find that the mesh of the two capacitors isn't quite the same. That's because L3, which is wound by hand, does not have exactly the same inductance value on either side of the center tap. (L3 is wound on a flat ferrite bar salvaged from an old AM radio using 5/44 Litz wire. If you carefully unwind the original winding on a ferrite bar coil, you can reuse it to construct L2 and L3.)

The diodes can be any general purpose small signal germanium types. Use an ohmmeter to pick out ones with the lowest forward resistance. This will insure the loudest possible audio at the speakers.

The very high impedance transformers can be found at hamfests and in surplus parts catalogs like Meshna's. You can also use two or three transformers obtained from old tube-type radios or televisions. Connect the high impedance primaries and the low impedance secondaries in series. Though it requires more room in the project cabinet, this provides an excellent speaker driving system.

"Powering Up"

Once construction is complete, attach an antenna of at least fifty feet and hook up a good earth ground. A cold water pipe is an excellent choice. You may want to use crystal headphones to do the initial tuning. The earphone volume will be astounding. When you switch to the loudspeaker, some retuning will be necessary since the speaker/transformer combination presents more of a load and reduces the tuned circuit's Q. Using the least amount of inductance off L3 (the fewest turns of wire) will generate the loudest received audio.

There are a lot of tunable adjustments on this radio, so preserve every bit of RF energy by properly matching each component to the next. Spend some time using all the various combinations of coil taps and capacitor settings. Optimum settings will change from one end of the AM band to the other. Try the narrow selectivity and notice how radio signals tend to snap in and out as compared to a conventional crystal set where a strong station takes up half of the dial. Because of this set's exceptional sensitivity and wide tuning range, you may also hear some older cordless phone signals around 1700 kHz. The audio will have the characteristic buzz from the FM carrier, but there is also an AM component in the signal and you'll be able to make out what's being said on both sides of the conversation. Enjoy! ■

Parts List

C1, C2, C3	365 pF variables.
L1	Loopstick antenna coil (Miller 6300) or 11'2" of 5/44 Litz wire on a 5/16" OD slug tuned form (scramble wound). Coil is ¾" long. Litz wire is available from Midco, 660 North Dixie Hwy, Hollywood FL 33020.
L2	12 turns 5/44 Litz wire over center of L3, tapped at 6th turn.
L3	80 turns 5/44 Litz wire on ¼" x ¼" x 3" ferrite bar (length not critical) salvaged from an AM transistor radio. Tapped at 10, 20, 30, 40, 50, 60, & 70 turns. See Figures.
C4, C5	0.001 mF.
D1, D2	Germanium diodes.
S1, S2	SPDT switch.
S3, S4	2-pole, 4-position rotary switches.
T1, T2	Very high impedance transformer with ≈ 8Ω secondary. Try a 4800/3.2Ω or similar, cat. #JT-19 (75¢) from John Meshna Jr., Inc., PO Box 62, E. Lynn MA 01904 ($20 minimum per order).

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73 Review

by Jim Gray W1XU and Peter Pedersen W7KTK

Procomm's Wideband Supercone

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A friend and fellow ham, on first seeing this unusual antenna on our tower, commented that, "It ought to be called the 'star burst' antenna!" The Wideband Supercone, a discone antenna, was introduced to the public at Dayton Hamvention '88, and it immediately caught our attention. We received one a month later and have been using it since.

Light, Attractive, Easy to Install

The Supercone is a "simulated" solid discone antenna made up of a series of horizontal radial spokes which form the disc, and a series of drooping radial rods which form the cone. The cone and disc skeleton are made up of stainless-steel rods, and attach to a milled aluminum and brass center "hub." The Supercone is shipped unassembled within a stout mailing tube. Along with the assembly instructions, Procomm includes some general information to help the user understand exactly what it is he or she has received.

One major difference between this supercone and other discones is the central vertical "whip" extending upward from the center of the disc. This is a separate vertical ground plane antenna for 10 meters.

The Supercone is both a transmitting and receiving antenna. It weighs about two pounds, and it's easy to install. The width of the base of the cone is 37". With its "whip" vertical antenna, it is 69" tall. A central support element of aluminum tubing attaches to the center hub portion to allow the Supercone to mount on a standard 1¼" diameter TV-type mast.

Continuous VHF/UHF Coverage

The Supercone covers from approximately 100 MHz to 1.2 GHz in the discone portion, with added coverage of the 10 meter amateur band provided by the above mentioned, helically-wound whip. As with all discones, frequency coverage in the VHF and UHF portion of this antenna is continuous rather than discrete. That means that ANY frequency within its range may be covered with a very low VSWR in the transmitting mode.

For receiving, the discone is almost ideally suited for use with a multi-band, multi-mode transceiver and, of course, with a scanner capable of covering its wide range. Essentially, the Supercone is a neat, compact, one-antenna installation for your shack.

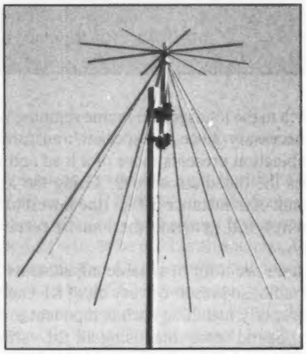

Photo A. The Wideband Supercone antenna mounted on galvanized water pipe. This Supercone covers 100 MHz–1 GHz continuously.

Fast Assembly

Our test antenna arrived in June, and we erected and tested it immediately upon receipt. From shipping container to tuneup, you can assemble the Supercone in about 15 minutes.

Because of its small size and "skeleton" structure, wind loading is negligible. Procomm doesn't take any chances, however—the "spokes" or rods that form the shape of the antenna are stainless steel. This eliminates many common weathering problems (more on this later).

We set the assembled discone on its "legs" in the shack for preliminary trimming of the 10-meter whip section. The discone portion needs NO TUNING AT ALL. After attaching a short length of 50Ω coax to the hub's SO-239 UHF-type connector (which mates with the PL-258 standard coax fitting), we attached the aluminum center tubing to the drilled and tapped central hub with a pair of 6-32 machine screws.

W7KTK's Evaluation

As of February, the Wideband Supercone has been in use for six months on 148 and 440 MHz. The feedline is 69 feet of Andrews 50Ω Heliax "hard line" with a six-foot length of RG8U coaxial cable connecting the antenna termination to the Heliax. We installed the antenna at the 50-foot level of my 65-foot tower, using a 5-foot, up-turned "L" arm to support it away from the tower legs.

The VSWR was brought as close as possible to 1:1 (as measured by a Bird "Thruline" wattmeter) on the 10 meter band while still standing on its legs in the shack. After raising it to the 50-foot level, we found that the VSWR was about 2:1 at the end of the feedline, probably due to the difference in its resonant frequency between the ground and the mounting location above ground. Heating of the plastic cap and sheath around the helically-wound short vertical antenna occurred at its tip (high-voltage end) with 100 Watts RF input applied to the transmitter end of the feedline. The heating caused a softening and deformation of the cap and the plastic sheath.

We removed the 10 meter vertical portion, and conducted further tests on 122.8 MHz (aircraft "Unicom" frequency), 147 MHz (a nearby repeater frequency in the 2 meter band), and 444.5 MHz (a 70-mile-distant repeater frequency in the amateur 70 cm band). The measured VSWR by the Bird wattmeter was 1.2:1 at 122.8 MHz, 1.1:1 at 147 MHz, and 1.1:1 at 444.5 MHz. This is a very creditable performance.

The "expand-to-five" attachment and the several whip antennas needed for operation on the HF bands may be practical, but we did no tests on them.

Improvements and Suggestions

The aluminum tubing support required a bit of re-working to provide a stable attachment to the center hub so that it wouldn't wobble. It was simple to replace the two-screw support with a three-screw support arrangement, with each machine screw fitted into a tapped and threaded hole 120 degrees from each other around the periphery of the hub. We understand from Ray Lukaszewicz that this has become a permanent "fix" on antennas now being delivered. The antenna mounting is now rigid and strong.

After six months of use, we have noted some galvanic action between the threaded ends of the stainless steel radial rods and the aluminum/brass center hub, as evidenced by a deposit of whitish aluminum oxide that nearly prevented easy disassembly of the antenna when it was taken down. The factory informed us that a small packet of conductive no-oxidation grease, similar to the type electricians use for joining aluminum tubing and protecting telescoping joints, now ships with every antenna. This is an inexpensive and simple addi-

continued to p. 43

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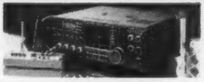

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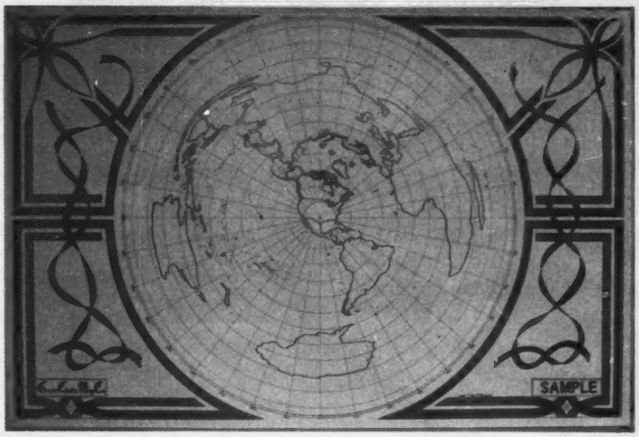

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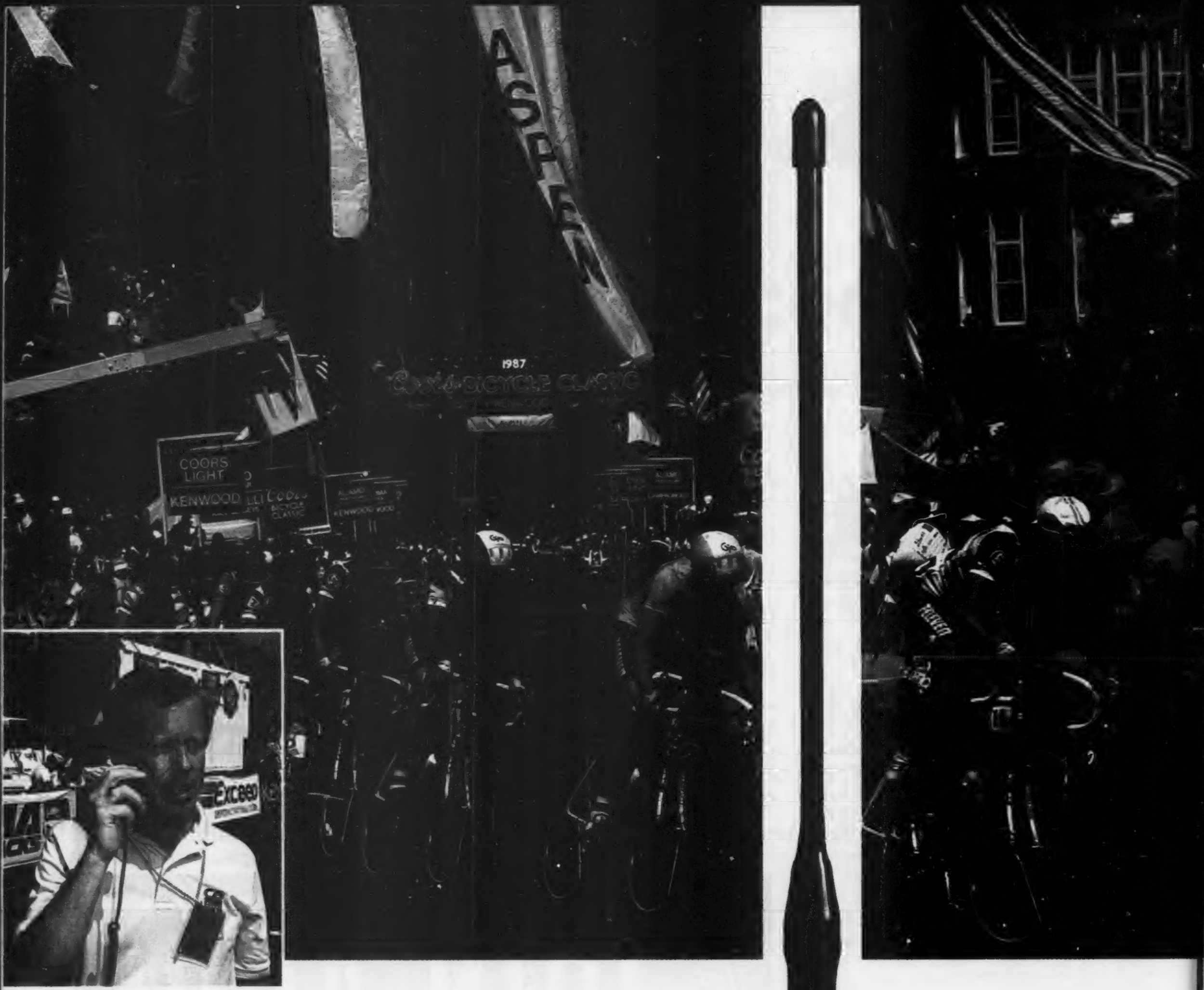

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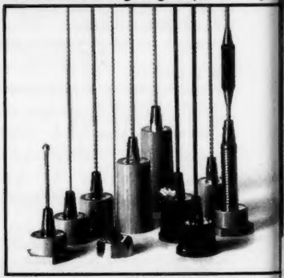

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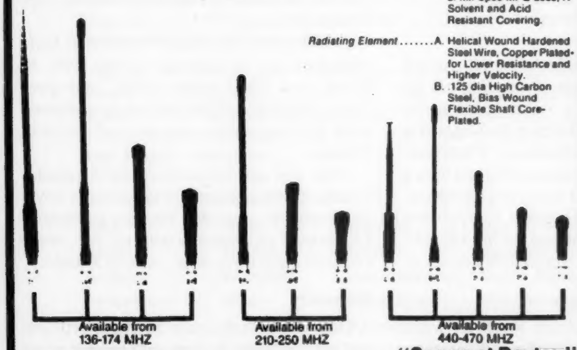
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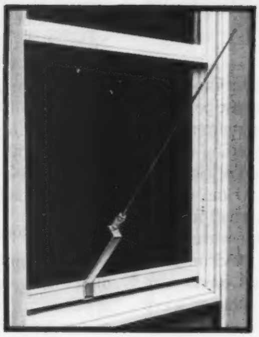

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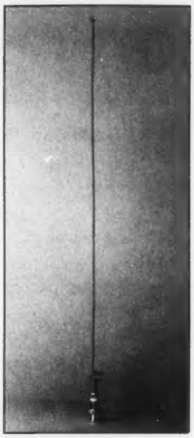


Low-Cost Easy-to-Build Antenna

For 146/440 MHz.

by Bob Witmer W3RW and Ed Clegg W3LOY

This easy-to-build antenna provides improved performance in range on both bands over the standard antenna ("rubber duck") currently supplied with the dual-band, hand-held transceiver. In addition, at less than 2 feet tall, it's space-efficient for mobile operation.

The Challenges

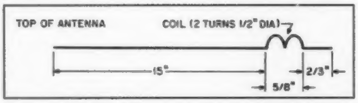
The recent popularity of compact dual-band 146/440 MHz FM transceivers has created an antenna problem for those owners who desire improved performance over the standard antenna. Improved performance antennas are available separately for both bands, but you have to change antennas when you change bands. This is hardly convenient.

We discovered, quite by accident, that this antenna, originally designed just for gain performance over a quarter-wave on 440 MHz, had dual-band capability.

How It Works

The antenna works in different modes on each of the bands. On 146 MHz, the performance is virtually identical to a quarter-wave whip. At this frequency, depending on the ground plane configuration, the performance can be significantly superior to the rubber duckie antenna, even within a small fraction of a dB of a conventional quarter-wave located in the same ground plane environment. The SWR characteristics and bandwidth also behave similarly to a quarter-wave monopole.

The real virtues of this antenna appear in the 440 MHz application. Many have been surprised to find that they were able to get some measure of performance when they operated on 440 MHz with a conventional 146 MHz whip. The fact is that a 146 MHz whip looks like a ¾-wave whip when used at 440 MHz. It presents a very acceptable SWR to the rig. Any piece of wire will radiate to some degree, in some direction. And there's the rub—*some* direction. Most of the radiation from a ¾-wave vertical whip over a ground plane is directed up into the sky! It will send a nice signal at about 48 degrees above the horizon. That's not where we want our signal to go most of the time!



Dimensions for the dual-band antenna.

The easy-to-build antenna, while occupying essentially the same space as the 146 MHz vertical whip, behaves quite differently on 440 MHz than the above sky-warmer. The secret is in the current distribution resulting from the addition of the "curly-Q" inductor inserted into the lower part of the whip. Because of the resulting current distribution, the antenna behaves similarly to the classical ⅝-wave vertical, which not only provides several dB of gain over a quarter-wave whip, but also directs its radiation along the horizon where we want it to go. (For a copy of the current distribution plots and MININEC radiation simulations for this antenna, send an SASE to the authors at *146 Forest Trail Dr., Lansdale PA 19446*).

The curly-Q inductor not only establishes the ideal current distribution, but also performs the impedance matching required to make a highly reactive, high impedance ⅝-wave whip look like the 35–60Ω resistive load we want to match to our 50Ω rigs!

Construction

The antenna is simple to build. Actual dimensions vary slightly, depending on the application, but in any case appear to be non-critical. Forming the base loading coil is the hardest part of construction. When constructing my mobile antenna, I worked with a stainless steel whip and formed it as such. It was difficult. I used 18-gauge Copperweld wire to construct the antenna for my 146/440 MHz handheld. It was considerably easier to form!

The easiest way to start construction of a mobile antenna is to obtain a quarter-wave VHF commercial high-band mobile antenna uncut for the operating frequency. This should provide you with all the material you need. Simply measure the antenna for the location of the loading coil, form the loading coil, and mount the antenna on the mounting base. Construction of a hand-held version is similar. Use any conductor material which will give you the desired size and structural integrity.

When selecting the material for your dual-band antenna, remember that you have to attach it to the antenna connector on your handheld. When I used 18-gauge Copperweld wire, I chose a BNC connector with a screw stud, left over from a broken 2 meter rubber duck. I formed a loop in the bottom of the antenna, and attached the connector and screw stud with a matching nut.

Adjustment

The next step is to trim the antenna for optimum 2 meter band operation. 440 MHz SWR usually does not appear to need adjustment since observed SWRs have not been higher than 2:1.

Performance

Mobile performance of my magnet-mounted version on 2 meters is indistinguishable from that of a regular quarter-wave whip. 440 MHz performance approaches that of a commercial "5 dB gain" antenna.

Performance of the portable version, which I have used on my 146/440 MHz handheld, shows a noticeable improvement on both bands over the standard antenna supplied with the rig.

On a 35-mile path with 3 Watts, 440 MHz operation proved superior to that with 30 Watts into the 2 meter whip, and gave barely detectable difference when compared with an expensive commercial vertical collinear!

SWR was not measured on the handheld. Complexities associated with antenna SWR on handhelds precluded such measurement. I have used this antenna with my HT, however, for quite some time, with no troubles.

Summary

This low-cost antenna is space-efficient and easy to build. It gives you greater range and versatility over the antenna supplied with your handheld transceiver.

For information on the availability of a commercial grade Clegg dual-band antenna, contact *Viatek, Inc., 350 Main St. E., Allentown PA 18106. Phone (215) 395-7222.*

JAMES MILLEN

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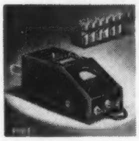

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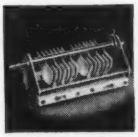

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Hamfest Survival Guide

Make the most of your time and money.

by William E. Newkirk WB9IVR and Robert L. Burton, Jr. AA4QA

Hamfests are the social event of the amateur radio world. Many people who go to hamfests don't think of the little things that could increase the enjoyment, comfort, and value of their trip. Here are some of the ones we've thought of.

Good Advice

1. Wear loose fitting, comfortable clothes. It gets very hot inside the exhibit hall because of all the people.

2. Park away from the crowd. Hamfest drivers are some of the worst we've ever seen. They get to talking on the mobile rig and run right into things. Look for a parking place away from the congestion, with trees for shade.

3. Pack a cooler full of food and iced drinks. The food at hamfests is often expensive and bad. With the heat and activity, dehydration can be a problem. If you have heart problems, take at least a 10-minute rest every hour.

4. If you are in the market for new gear, remember most retailers give 20% discounts at hamfests. But get there early in the day to do your shopping. By late afternoon, the good stuff has usually been sold.

5. Always barter, even when buying new equipment! People come to a hamfest to get a good deal, and the sellers know it. Expect to get even bigger discounts on used gear.

6. If you are a Novice, don't be afraid to ask someone for help. Buying your first rig can be a little overwhelming. If you don't know anyone there, go to a club table or the QCWA (Quarter-Century Wireless Association) booth and ask for help. If you have an Elmer, but you can't locate him, have him paged or ask someone with a handy-talkie to call him.

7. Don't be shy about asking questions. Ask as many questions as you can! Talk to everyone. What is this for? Who are those guys in the funny orange vests? Why is that guy wearing a dish on his head? Hamfests are a great place to meet people with like interests and to learn from each other.

8. If you don't want to buy any equipment, check out the books. In the dealer section (i.e., "new gear"), many companies sell a wide selection of how-to books as well as operating aids and maps, call directories, and software.

9. When buying used gear: a) don't buy military surplus unless you are a collector; b) don't buy any gear over 20 years old; and c) don't buy any gear too big to carry.

Good Used Rigs

Heathkit HW-101, SB-10X series (e.g., SB-102, SB-104, etc.) gear can be fixed with very little test equipment, and the manuals are great. Prices range from $100–150 for a 5-band transceiver in working condition, with manuals, to $30–75 for gear in not so good condition. Keep in mind that most of this gear can be repaired and parts are available.

What follows is a typical event from the results of bargaining:

1. Old HW-101 5-band rig, less manual and power supply. I paid $35; the man was asking $50. (Rigs of this vintage all had separate power supplies, typically requiring 250 volts, 6 volts, 450–700 volts DC to operate.)

2. HW-102 power supply bought for $10 two aisles over from the first purchase.

3. Manual bought with power supply, total cost $45.

4. Repairs: three new filter capacitors $4 each, $12 total; three new final amplifier tubes (I bought these just to be sure) $6 each, total $18.

5. Total cost of 5-band radio = $45 + $12 + $18 = $75.

Other Good Tube Rigs

Drake TR-3/TR-4. Five bands, 300 Watts output, used price, $200–300. Power supply and speaker or headphones are separate. Last variant was the TR-4cw with provisions for optional CW filter. Noise blanker optional. Another popular product line was the **R-4n** and the **T-4Xn** series. The last produced variant was the R-4C and T-4XC. The T-4XC needs a separate power supply, and the receiver needs a speaker or headphones. The receiver can be set up to accommodate any frequency in the HF spectrum from 500 kHz to 30 MHz (except 5–6 MHz). The receiver's VFO can control the transmitter for a general coverage receiver/transmitter combination. The FS-4 synthesizer eliminates the need for a small army of crystals on the R-4x receiver. The FS-4 is a rare item.

Swan 500 transceiver. Five bands, 500 Watts output, used price $250–400.

Collins 32S-( )/75S-( ) and **KWM-2( ).** Five bands, 100 Watts output, used price of $400 and up (collector's item). This product line was discontinued in the mid 70s, but the popularity of the units in their prime has created a small but dedicated support system of after-market companies.

National NCX-5. Five bands, 180 Watts output, used price $150 to $300. **NCX-3.** Three bands (10, 15, 20), used price $100 up.

Newer Transceivers

Kenwood TS-5x0 series. Solid-state with tube finals. 100 Watts output, $300 and up. **TS-120.** Solid-state, 100 Watts output. Has a typical used price of $200 and up. **TS-130.** Like TS-120, but includes 1979 WARC reassignments (10, 18, 24 MHz), somewhat better receiver. Has a typical used price of $300–400.

ICOM IC-701, 720, and **721.** All solid-state. 100 Watts output. $300 and up. Some units may be remote-controlled by optional controller.

Drake TR-7. Solid-state, 100 Watts output, used price of $500 and up.

Yaesu FT-10X series. This is the choice of illegal operators in the US. Originally, it came with one band set up for the 27 MHz Citizen's Band. The FT-101 and follow-ons are good gear and work well. They have up to 100 Watts output and are all solid-state except for tube finals. They sell used for $300 and up.

New Transceivers

Kenwood TS-140/TS-680. All bands plus general coverage receiver. 180 Watts output. $800—1000, depending on options.

TS-680 includes 50-54 MHz operation in place of a built-in VOX circuit. **TS-440:** All bands with lots of extras, 180 Watts output, but $1000+. **TS-430:** All bands, older version of the TS-440. $600+ if you can get someone to part with one.

ICOM IC-735. Like the TS-430/440. In the $800—1000 price class. It has an excellent receiver section.

Problems with Old Gear

Tube Gear must run off high-voltage, and it isn't portable. It may take some work to get it running. Of course, you may get lucky. Many new hams find tube gear a cheap way to get on the air. All of the models mentioned work well and have parts and tubes available for them. There are companies that produce and market solid-state replacements for tubes! When looking for older gear, Heathkit is one of your best bets.

Home-brew. If you're interested in home-brew, there are some nice designs out there, but the cost is equivalent to purchasing good used gear. Home-brew takes a lot of work. Still, you should consider this if you want a modification you can't buy, and have a lot of patience.

New gear is very nice, but the prices are going up and up with the price of the yen. Get to the hamfest early and shop around. Try to get the best price and buy it now before the price goes up again.

Testing Gear Without Power

When checking out a piece of gear, there are many things to look for. Here are some common items to check for when you are examining flea market gear. First, we cover evaluating a rig when you don't have a power source, then we give a checklist for testing the rig with power.

1. Is the equipment clean? Is the paint in good condition? Little or no rust?
2. Is the operating (maintenance and service) manual with the radio? Is it complete, without missing or unreadable pages?
3. Check the fuse. Is it good, and of the correct value?
4. Check for missing cabinet/chassis screws.
5. Check inside for loose hardware.
6. Is the control panel labeling clear and readable?
7. Check for smooth switch operation. For example, if the band switch is hard to move, or turns roughly, it might need repair or replacement.
8. Be sure that the controls turn without binding or backlashing, and that they have no loose couplers or universal joints. Check the main frequency tuning knob, and especially the driver and final amplifier output knobs on tube transmitters. If they wobble or move too freely, the couplers are loose and perhaps defective.
9. Check the frequency dial for excessive wear. For example, a part of the frequency dial's lettering may be worn off.
10. Check for missing but needed connectors, like the octal plugs used for connecting other gear to the rig. Another special item is the TS-520's VFO jumper plug, needed when no remote VFO is used. This is very important. You can't operate a radio until all the connectors and cables are installed for proper input, output, and bypass hookups, no matter how pretty it looks! These items may be available at the show.
11. Check for missing components, like noise blankers, crystals, or crystal decks for receiver local oscillators, tubes, dial cords, and bandswitch drive chains.
12. Check for broken, sprung, or bent meter pointers or movements, cracked meter cases, and out of place meter scales. If any knobs are broken or cracked, you will probably find replacements at the hamfest.
13. Check the tubes. Are any cracked? Are they all marked with their tube types? Or is this in the manual? Many good tube sets will have the proper tube type designator stamped next to its socket. However, this may be covered by years of dust, so bring a small rag to clean around the tube socket. Don't handle the tubes with your fingers whenever possible, since oils from your fingers can deposit on the tubes and heat up and weaken that part of the tube.
14. Check ON/OFF switch continuity through the power cord with a volt-ohmmeter. This should be open when the power switch is off and a low ohm reading when the power switch is on.

Testing Gear with Power

1. First, check all the items above.
2. Check for voltage programming before plugging in the power supply (set adjustable units to the current voltage in your area). Most late models have a selector switch in back near the power connection.
3. If possible, check power supply output voltages before connecting the unit. Make certain the cable from a separate power supply has all the proper voltages on the proper pins of a connector before hooking up the rig.
4. Apply power and see if all pilot lamps, displays, and indicators illuminate properly.
5. If possible, check for proper operating voltages inside of unit.

Receivers

6. You should hear at least some static in the receiver's speaker. This noise should increase if you touch your finger or screwdriver to the antenna input. You should be able to hear some signals on most bands, in most cases. A working calibrator with minimum static implies the antenna isn't connected to the radio (bad T/R relay? cold solder joint?) but doesn't indicate problems elsewhere in the receiver.
7. Check both speaker and headphone outputs. You may need a spade lug to an appropriate phone/phono jack, or other adapter, so headphones can double up for this job.
8. Check for excessive hum in audio (bad power supply, filter section).
9. Check the controls for noisy operation.
10. Does the receiver hear signals in all receive modes—upper sideband, lower sideband, and AM?
11. A radio may have a problem only on USB due to a bad switch, crystal, or oscillator.
12. Do the switchable filters affect speaker noise or selectivity?
13. Check the notch filters, Q-multipliers, etc., and how they affect the received signal.
14. Check the passband filter tuning. How does it affect the received signal?
15. Check AGC FAST/SLOW control, and how it affects the received signal.
16. Check the receiver calibration with WWV (10 MHz, 15 MHz AM) or CHU (7.335 MHz USB). If your receiver is tuned, you should hear the same pitch for either sideband setting on WWV.
17. Check RIT/clarifier controls for clean operation.

Transmitters

18. Test output power using a common light bulb of sufficient wattage. This way, you can quickly check tube transmitter output on all bands (though a dummy load and wattmeter would be better). This may be wired to a connector and plugged into the antenna terminal. For many rigs, like the TS-520/FT-101/T-4XC, use a 100 Watt lamp. Rigs like the TR-3/TR-4 require a 150-200 Watt lamp. Most solid-state power amplifiers in the amateur radio market will probably reduce power because of the bulb's reactance; this results in poor output even when everything is really in good shape.
19. Make sure the input current to finals is close to the normal values given in the operation manual.
20. Use a frequency counter or receiver of known quality to check the transmitter's frequency calibration.
21. If possible, bring a small receiver (e.g. a Ten-Tec Argonaut) and an attenuator to attach to it, to avoid front-end overload. Attenuators are inexpensive to put together, and you can find the plans for them in the *Handbook* and other sources. Use this setup to estimate audio quality and distortion of the signal of the transmitter in question.
22. Using the setup in #21 estimate sideband suppression on sideband modes.
23. Again with the setup in #21, check for key clicks, backwave, splatter, and harmonic radiation.
24. Does the peak power output correspond to the minimum plate current? If not, this can indicate that you may need to adjust neutralization on the final amplifier.
25. Check the XIT/transmitter offset controls; do they vary transmitter frequency?
26. How well does the speech processor work?
27. Check the idle current on the final amplifier. On many tube transmitters, go to SSB and key the transmitter, but don't modulate. The plate current displayed on the meter will be the idle current. For many finals using 6146-type tubes, this is around 60 mA.

We hope you find the information in this guide to be helpful the next time you go to a 'fest. See you there!

How to Feed an Apple to an IBM Monitor

Feed a digital RGB monitor from your Apple for under ten bucks.

by W.K. McKellips WB4DCV

In the times before PC clones (1980), I bought the Apple II+ and paid a bundle for it. I didn't buy a monitor then because it cost too much. Instead, I bought a little add-on RF modulator so I could feed the computer output into the antenna jack on an old Zenith black and white TV I had sitting around.

The setup worked, but the text on the screen was like a message from Mars. I even had a little static in there with it. What I most definitely needed was a real monitor! But that meant spending more money . . .

When the next hamfest came along, off I went and came back with a pretty little composite color monitor. Wow! Now the text was readable. The colors were great and I was in computer heaven—for about six months. Strange! I noticed that the text still wasn't as sharp as the monitors at work. I was told I needed an RGB job. So I bought one.

Getting In Deeper

Now I was really in for it. In order to feed my Teknika RGB monitor, I needed an RGB adapter card. I'd also need an eight-wire cable with a DIN plug on one end and a DB-15 plug on the other. The salesman at the computer store didn't think his card would match the monitor to my old Apple II+. I'd have to have a special cable made. He knew a guy in the next town that used to make cables, but he wasn't sure if the guy was still alive. The rut got deeper and deeper.

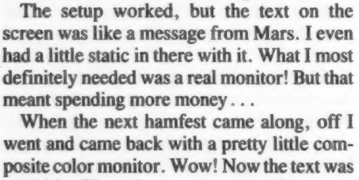
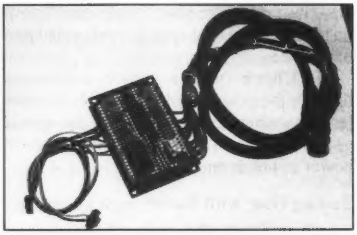


Figure 1. Edge of the Radio Shack #276-150 perfboard, on which the video adapter circuit is wired. Remove the 74LS51 IC from its socket on the motherboard, insert socket plugs, and reinsert the chip into the socket.



The adapter and cable that plugs into the Apple motherboard and an the IBM monitor.

Ham Ingenuity

Enter the Ham Spirit. I was truly tired of the crude graphics, and was determined to have a good, crisp, single-color display for my word-processing and databasing.

I consulted my Teknika owner's manual and noted which pins on the DIN connector went where. I then looked over the schematic for the Apple. Duck soup! On the Apple motherboard, the IC at location C13 is a 74LS51. The combined vertical and horizontal synchronizing signals leave the 74LS51 on pin 8 and mix with video at the base of Q3, a 2N3904. If you have an Apple-type monitor, you're already there. You've got your combined negative horizontal and vertical synch. All you need is some positive video from the Apple output jack. In the meantime, I'll show you how to feed an IBM style monitor.

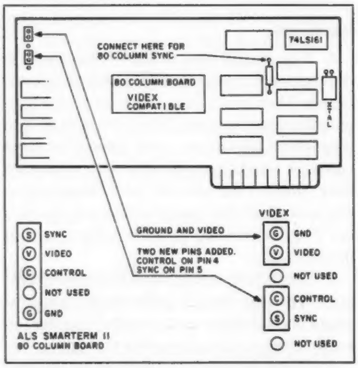


Figure 2. Diagram of the Videx compatible 80 column board. The solder pads in the upper left corner of the card are the connection points to the adapter. Lower left of the figure shows the adapter connection points for the ALS Smarterm II 80-column card.

Only Two Ingredients

All you need to do is take the combined synch, separate the vertical from the horizontal, and invert. This is neatly done with a single 74LS157 and a transistor. Grab the video and give it a little boost and you have all the ingredients for your IBM RGB!

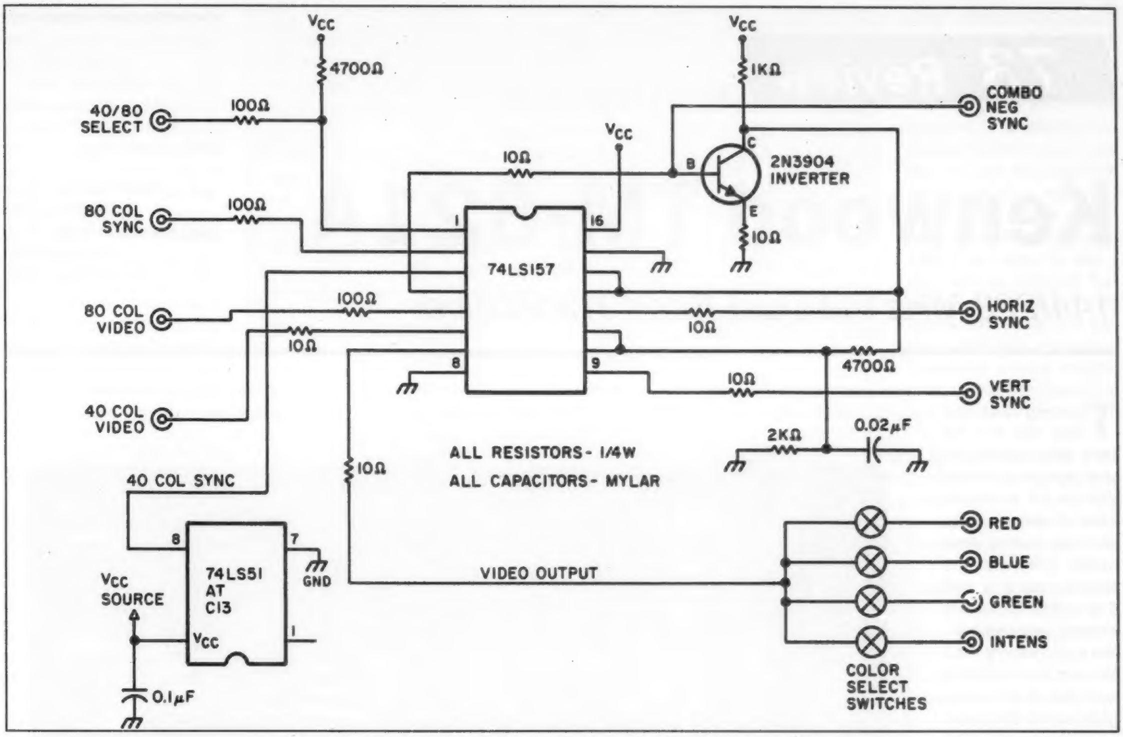
I didn't want to dig into the printed circuit motherboard, so I assembled the adapter on a small Radio Shack experimenter's board (RS #276-150). Ninety-nine cents seemed like a good price to pay for an adapter board. My version was hand-wired, but a printed circuit board would look prettier.

The board is about two by three inches with the input leads soldered on one side, and the monitor cable leads on the other side. It plugs into the Apple motherboard, and the cable is wedged into the cable slot at the back of the Apple to give the leads slack. The "case ground" wire in the cable is grounded to the bottom plate with a small alligator clip.

Making the Connections

See Figure 1. We make the necessary connections by pushing a wire-wrap 14-pin socket through the holes on the Radio Shack board and carefully soldering each pin to the board. Try to find a wire-wrap socket with the shortest pins so the assembly won't set so high on the motherboard. While we're at it, solder a 16-pin soldertail socket on there, too. The wire-wrap sockets are also available at Radio Shack.

Now plug the original 74LS51 into the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10Ω
B
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2N3904 INVERTER
80 COL SYNC
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1
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10Ω
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100Ω
HORIZ SYNC
10Ω
10Ω
8
9
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40 COL SYNC
8
7
GND
RED
74LS51 AT C13
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BLUE
Vcc SOURCE
GREEN
Vcc
1
INTENS
COLOR SELECT SWITCHES
0.1μF

Figure 3. Schematic of the video adapter.

wire-wrap socket and plug the wire-wrap socket into the motherboard socket at position C13. Please note the IC is oriented with pin one facing the keyboard. The pins on the wire-wrap socket are larger than IC pins, so be careful when you ease it into the socket at C13.

To get our signals, we run three wires from the 74LS51 socket to our 74LS157. These furnish ground, VCC, and 40 column synch.

Circuit Operation, In Brief

For our project the 74LS157 is a fancy four-pole double throw switch. Two of the "switches" switch from 40 column to 80 column synch with video to match. The 2N3904 inverts the signal, and the other two 'LS157 sections are wired to separate the horizontal from the vertical synch.

Switching from 40 to 80 Columns

Your 80 column card, if you have one, makes it possible for you to switch from 40 to 80 column mode. If you don't have one, then ignore all the 80-column connections. Just run a wire from your 40 column video, "V40" to an RCA plug, and plug it into your Apple video output jack.

Figure 2 shows samples of ALS Smarterm II and Videx control sockets. The ALS card switches your adapter board automatically when you type "PR#3." The Videx compatible board has six solder pads for a control socket. There is a miniature 2-pin connector on the top two pads. The first is ground, the second one down is video. The third one is VCC. Install another miniature 2-pin connector on the fourth and fifth solder pads. Pin four will be our 80 column control wire (it's a ground). Run a small wire from pin five (formerly unused) to the top of the 2200Ω resistor located in the top right hand corner of the Videx board. That's where you'll find the 80 column synch. We don't use pad six.

The Video Adapter Board

On the Videx board, you automatically go to 80 column mode when you plug your cable into it. A high on the control line gives you 40 columns, and a ground or low, switches you to 80 columns. If your 80 column board doesn't have a control signal, then use a miniature switch to ground the control line for 80 column mode.

Video output on the adapter board is divided up between Intensity, Red, Blue, and Green output. The output impedance for the 'LS157 is mismatched to the cable line, but since my monitor cable is only three feet long, there is no apparent degradation of the signal. See Figure 3.

Note that in IBM monitor mode, you would use the horizontal and vertical synch outputs. For an Apple monitor, use the combo synch output and don't use the HORIZ or VERT outputs at all!

On my version, I mounted a small DIP switch in series with the red, blue, green, and "intensity" outputs. This allowed me to have an all-green or all-amber text screen, as desired. As it turns out, I didn't like the green-screen effect, but there may be some people who do, so I'm including that circuit in the diagram. Juggle the switch settings to get any single color, or white, as you want.

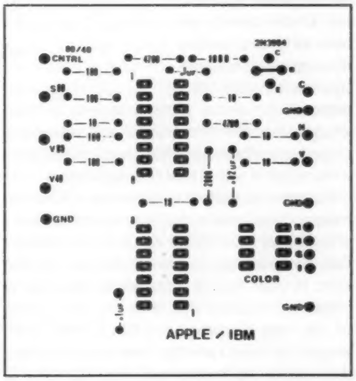

80/40 CNTRL
2N3904
S80
V80
V40
GND
COLOR
APPLE / IBM

Figure 4. Suggested perfboard parts placement for the adapter.

The adapter, as shown, runs perfectly on my Teknika MJ-22 in IBM mode. There isn't any reason why it shouldn't work equally well on any other make of RGB monitor. If one is willing, or if one is Scotch (as I am!), just check the users manual that comes with the monitor, and prepare a cable. The adapter board schematic shows where the wires go. If one exercises the Ham Spirit, one can build it. If one builds it, one saves much money! ■

Number 9 on your Feedback card

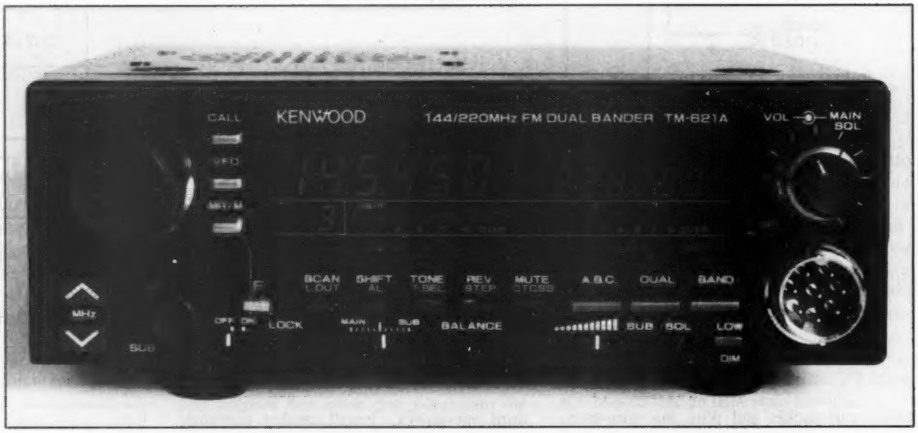
73 Review

by Paul Grupp KA1LR

Kenwood TM-621A

144/220 MHz FM Dual-Band Transceiver

Kenwood USA Corp.
PO Box 22745
Long Beach CA 90801-9745
(213) 639-4200
Price Class: $730



The Kenwood TM-621A—the world's first 2m/220 MHz dual-band mobile rig in a single box.

Throughout the late 70s and the early 80s, most hams who operated mobile did so on a single band: 2 meters. Now, in many metropolitan areas, 2 meters has become so crowded that normal QSOs are nearly impossible. This crowding has forced increasing numbers of us to migrate to 440 MHz, and most recently, 220 MHz. With the notable exceptions of NYC and LA, these bands are relatively uncrowded throughout the country. You can listen to a repeater for hours without hearing a "ker-chunk," and the term "QSO" still refers to a conversation between individuals, rather than a round-table with a cast of thousands.

For several years now Kenwood, ICOM and Yaesu have made dual-band transceivers which cover the 2 meter and 440 MHz bands. But, if you wanted to have 2 meters and 220 MHz in your mobile installation, you had to install two separate rigs. With the introduction of the new Kenwood TM-621A, this is no longer the case. Now 220 MHz fans can have their cake and eat it, too! The TM-621A is identical in features and packaging to the 144/440 MHz Kenwood TM-721A.

Features and Controls

With the power turned off, a casual observer might conclude that the TM-621A is just another compact 2 meter transceiver. Turn it on and the dual frequency displays light up, suggesting that something more interesting might be going on here. The TM-621A is a dual-band radio in the sense that it can receive on two frequencies simultaneously, and a variety of unique controls and displays are provided to support this type of operation.

The frequency display on the left is referred to as the "main display," and the slightly smaller one on the right is referred to as the "sub display." Either band can be monitored on either display, although you can't monitor the same band on both displays. The sub display functions as a dumb monitor receiver. It can monitor the VFO or memory frequency of your choice, but that's about it. All transmitting is done from the main display, and the various scanning features are active here. Each display has a separate S-meter.

> ***"Because the two receivers are truly independent, full duplex operation (on separate bands) is possible."***

Obviously, useful monitoring of two bands simultaneously requires some special controls, and Kenwood has provided them. Each display has its own VFO knob, used either to tune up and down the band, or to select a memory. The MAIN SQUELCH is located concentric with the volume control, while the SUB SQUELCH is a sliding control located near the bottom of the front panel.

The BALANCE control adjusts the relative audio level of the main and sub receivers (the receiver audio is mixed internally before it is sent to the single internal speaker or rear panel audio output jack). The MUTE switch drops the audio level of the sub receiver by about 20 dB, allowing you to give your attention to the main receiver without disturbing the setting of the BALANCE control.

Pressing the DUAL switch deactivates the sub receiver, causing the TM-621A to function like a conventional single band transceiver. This is useful for public service or emergency operation where you are only interested in one band.

The BAND switch exchanges the frequencies in the main and sub displays. The ABC (automatic band change) switch activates an entertaining mode which performs the same function whenever a signal is received on the sub display frequency. This first appears to be a mere gimmick, but it is actually quite useful. Suppose, for example, you are waiting for a friend to call you on the sub display frequency. Without ABC, you'd have to switch bands manually to answer a call, since the rig can't transmit on the sub frequency. The ABC considerately handles the job for you.

Because the two receivers are truly independent, full duplex operation (on separate bands) is possible. You don't have to do anything special to use this feature. Just grab the mike and start transmitting—the sub receiver remains active. On simplex frequencies, or in an area with linked 2 meter and 220 MHz repeaters, full-duplex operation can be quite an enjoyable experience.

That completes our tour of the controls and features relating to dual-band operation. The rest of the controls are comparable to those found on any other full-featured transceiver. Describing them here in detail would require several pages. Suffice it to say that nearly every conceivable feature is provided for, including scanning, automatic offset selection according to the ARRL band plan, and CTCSS encode and decode (with an optional accessory).

Dimensions	(W x H x D) 5.9″ x 2″ x 8.6″ (150 x 50 x 219 mm.)
Weight	3.97 lbs. (1.8 kg.)
Power requirements	13.8 VDC ±15%; <9.5A TX, >0.6A RX
Receiver circuitry	Dual-conversion superhet
Sensitivity	144 MHz: less than 0.2 μV
(12 dB SINAD)	220 MHz: less than 0.18 μV
Selectivity	−6 dB: more than 12 kHz
	−60 dB: more than 24 kHz
Spurious response	Better than 60 dB
Audio output	More than 2 W into 8Ω
	(5% distortion)
RF output power	144 MHz: 45 Watts
	220 MHz: 25 Watts

Table 1. Manufacturer's Specifications.

Connections and Accessories

The TM-621 has the same 8-pin mike connector found on every Kenwood radio produced in recent years, so any mike or TNC cables wired for Kenwood gear will work here without modification. The MC-48B DTMF microphone is furnished as standard equipment.

As with many other compact radios, all connections to the rear panel (with the exception of external speakers) are made via pigtail leads. The large heat sink fins simply do not allow room for conventional antenna and power connectors.

Tantalizingly, there is a knockout on the rear panel for a third antenna connector, and unused space and mounting holes inside the rig for another power amp board. One might speculate that some future version triband radio is planned for the same chassis. But bear in mind that this would require a complete redesign of the rest of the radio's boards, since there is absolutely no way that they could be easily modified for this application.

There are separate antenna connections for 2 meters and 220 MHz, which means that you'll either have to use separate antennas for each band, or attach an accessory duplexer and dual-band antenna. At press time, no manufacturers were offering duplexers or dual-band antennas for 144/220 MHz.

In general, the manual provided with the TM-621A was well written and complete. However, I was dismayed to note that the adjustment instructions Kenwood usually provides for low power output, mike gain, beeper level, etc. were absent. I hope this doesn't reflect a trend!

Circuit Configuration

The TM-621A offers generous out-of-band frequency coverage (receive-only as shipped from Kenwood). It covers from 138 to 173.995 MHz, and from 215 to 229.980. This extended coverage is useful for monitoring a variety of public service transmissions, including NOAA weather at around 162 MHz. Power output is rated at 45 Watts on 2 meters, and 25 Watts out on 220 MHz.

You might naturally wonder if performance compromises were necessary to obtain dual-band operation in such a small package. An examination of the schematics and block diagrams provided with the TM-621A quickly puts those fears to rest. From an RF point of view, there are in fact two separate transceivers inside the single box. On the receive side, each band has its own bandpass filters, RF amps, mixers, and IF stages. On the transmit side, each band has separate PLL, VCO, drive, PA, antenna switch, and low-pass filter circuits. The only shared circuitry is in non-critical areas like microprocessor control and audio amplification. Because Kenwood was free to design separate RF sections for each band, there is no reason to believe that any compromises were made. Indeed, the performance specifications (shown in Table 1) bear this out. The specs are as good as (and in some cases, better than) specs from Kenwood's much larger single band radios.

> ***"I have never experienced problems with desense or squelch breaking when transmitting on one band while listening to the other."***

In Use

For several months now, the TM-621A has been installed in the headliner of my 1976 Ford van. Separate ⅝-wave Larsen antennas are mounted about six feet apart on the roof. I have never experienced problems with desense or squelch breaking when transmitting on one band while listening to the other.

Surprisingly, the mounting bracket is simply attached to the radio with four screws. This isn't a problem for permanent in-dash installations, but when the radio is mounted under a dash, the slip-in locking bracket that Kenwood provides with many of its other mobile transceivers would be a better choice. It would allow the radio to be more easily removed for security.

The amber display was readable under all conditions—even bright sunlight. The front panel controls are reasonably well-lighted, which is fortunate. I counted no less than 22 switches and controls, nine of which are mounted in a straight line across the front panel. Unless you are very talented, operating this radio by touch alone is not something that will come easily. After a few days of use, I was able to operate frequently-accessed controls like the BAND, AMC, VFO and MR/M switches by touch. Even after several months of use, I find it necessary to look at the front panel to operate controls like SHIFT, SCAN, and MUTE.

In my noisy van, audio performance from the tiny internal speaker was inadequate. Connecting two external 5¼″ speakers solved the problem, providing more than enough punchy, intelligible audio under any conditions.

Basic RF performance was superb. I made no attempt to confirm the manufacturer's claimed specifications, I did carefully examine real-world performance. I compared the 2 meter section to the ICOM IC-28H, and the 220 MHz section to the Kenwood TM-3530A. In all cases, the TM-621A matched or out-performed the specific units in my possession.

I often commute along a stretch of highway that is bombarded with severe leakage from the cable TV service that runs parallel to the road. Several radios I have owned or borrowed suffer ill effects, including desense and squelch breaking. The TM-621A completely ignored the problem. I noticed similar improvements in intermod rejection during my frequent visits to the RF-laden cities of Boston and Cambridge.

Out-of-band receiver performance was excellent. I frequently listen to NOAA weather broadcasts, and the TM-621A is significantly more sensitive than earlier generation extended coverage radios.

Conclusions

If you have any interest in 220 MHz, the TM-621A deserves your attention. It is an ideal radio for Novices; you can operate 220 MHz now, and when you upgrade you can immediately begin using 2 meters without buying yet another radio. Hams with higher class tickets will appreciate the full duplex capabilities and the many features designed to make it easier to use to use two bands simultaneously.

The TM-621A is not inexpensive, and with a little shopping around you might be able to find separate 2 meter and 220 MHz rigs that together are slightly less expensive. But you'd be missing the many useful features that make a dual-band radio a much more convenient choice. Unless you buy radios by the pound, and like the idea of having two microphones constantly getting tangled up together, the TM-621A's superb performance, unique features and compact size make it a radio worthy of serious consideration. ■

Number 18 on your Feedback card

WA6TEY 144/220 MHz RDF Quad Antenna

T-Hunters take note! Here's a simple project that gives you a highly directional gain VHF RDF antenna.

by Dr."Kuby" Kubichek N6JSX

The TEY Quad antenna has no capacitance or inductive matching networks. Matching networks cut down the efficiency of the antenna by adding more electrical components into the RF line. Major physical distinctions of this quad design from other designs are:

1. The Bazooka balun (an RF choke).
2. The diamond shape, which is sturdy and easy to construct.
3. The use of discarded TV antennas.
4. Versatility. By dropping all 220 references, you can construct a 2 meter monobander.

Compared to a yagi, the WA6TEY Quad antenna is small. It is lightweight, with low wind loading, and has good directivity. It's easy to build, and inexpensive, costing about ten dollars in materials.

Gain is about 6 dB for the 4-element quad. It has a full-wavelength driver, a true 50Ω load with no capacitive or inductive matching devices, and it is broad-banded with low VSWR across the band. The front-to-back ratio is good, with an average of more than 4 S-units difference.

Great for T-Hunting

About 60% of the mobile direction finders or T-hunters in the Los Angeles area use the 2 meter, 4-element version quad. Quads are used by T-hunters because they have the most gain for their size and they exhibit directivity no matter what the polarizations of the radiated signal are.

Promise Fulfilled

This quad was designed by Ray Frost WA6TEY, a pioneer of VHF quad designs, and a renowned T- and jammer-hunter. At our last meeting in August 1985, Ray asked me not let his quad design die with him. In September, Ray became a Silent Key after a hard fight with cancer. He had built an estimated 300 base 2 meter quads in single and paired configurations. The most notable of Ray's designs is the Mobile Direction Finding Quad. Ray gave them all to promising new amateurs in Southern California, never asking for, nor accepting, any remuneration for his quads. Ray only asked that the quad recipient "be a GOOD amateur."

Just before Ray passed away, he gave me all his antenna design notes and reference materials and told me to expand them. Ray was one of the prime authors that spearheaded the successful passage of Public Law 97-259. This law allows the FCC to enlist the assistance of amateurs for monitoring the bands for rule violations and for gathering evidence. I was truly fortunate to be Ray's last T-hunting partner, as he was an outstanding teacher of the HUNT. Ray was revered as one of the best hunters during his time, and many people will surely miss him.

> ***". . . a change in polarization can make quite a difference in the S-meter level."***

The History of the WA6TEY Quad Antenna

The goal of this antenna was to allow directable 220 HT communication. This would minimize overheard communications between cooperating hunters when they are exchanging information concerning strategies for nailing an illegal signal. At the time this antenna was designed, most of the amateur community was rock-bound and avoiding the 220 band due to this equipment restriction.

The most obvious physical feature of this quad is the reverse spacing between elements. This design was an experiment by Ray to see if he could obtain good directivity, match, and usability of the 220 band. But the surprising trade off to the 2 meter side of this antenna proved to be a real improvement to the 2 meter T-hunting capability. True, the gain of the 2 meter antenna was reduced slightly, but the front-to-back ratio was increased. The really big plus was the reduction of side lobes and thus the enhancement of a very dominant directive frontal lobe. The advantages are clear in the world of mobile flutter and the need for speedy good directive resolution.

Polarization Makes a Difference

The feedpoint of the antenna determines the polarization characteristics of the antenna. On a diamond-shaped quad, the feedpoint on either end of the horizontal spreaders will give the antenna vertical polarization. Putting the feedpoint on the vertical spreader will give horizontal characteristics.

Another technique commonly used for quick polarization changes is the construction of the boom and mast with PVC and PVC "T" section. This allows free ninety degree or less rotation of the quad for polarization change. This is important because a change in polarization can make quite a difference in the S-meter level. It will also often indicate a very definite peak on the meter. This allows you to make a more refined and accurate beam bearing. This polarization comparison technique can also give some insight as to multipath and reflections being seen. Most multipath and reflections are usually some other polarization, than that of the actual transmitting antenna. When the antenna is in an opposite polarization configuration, the signal may appear to have a broad peak on the S-meter—as much as twenty-five degrees.

Considerations Before Building

The more metal on the spreaders, the less dowel to treat. This is important to remember, especially in Southern California, where the heat, wind, rain, and smog, weather antennas quickly.

Before construction, decide if the permanent mast is to be metal (conductive) or plastic/wood (non-conductive). Be sure to use the the appropriate mast when tuning so that you will make the proper compensations.

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Number 10 on your Feedback card

73 Review

by Tom Guntzel KE0KB

Aries-1

Deluxe RTTY logging program.

Ashton ITC
PO Box 1067
Vestal NY 13851
PH: (607) 748-9028
Price Class: $90

Consider me an ardent RTTY enthusiast. Having recently upgraded my computer equipment to a PC compatible and my TU to a PK-232, I was anxious to find a software package that would take full advantage of both.

Searching the ads of various publications led me to a program called Aries-1. The ad touted the software's ability to insert the time and date (from the computer) and the frequency and mode (from the transceiver if properly interfaced) into a real time logging program. It would also operate in a special contest mode which would automatically check for dupes as well as allow for abbreviated log entries. All this while supporting all the operating functions of a PK-232 or KAM. Additionally, the program would allow the user to enter data into the logger and control all functions with a mouse as well as with the keyboard. The Aries package had the features I was looking for, and it quickly became a new addition to my software library.

Quick Startup

After a quick look at the well-written manual, I had the software up and running. I found that modes could be quickly changed with a function key or mouse click and that the default values built into the program were adequate for normal operation (they can be changed with the addition of a special file on the program disk). While not spending a lot of time in the CW, AMTOR, or packet modes, I did verify that they operate as expected. Checking into a local packet BBS was as easy as a mouse click away. Aries shines brightly on the RTTY bands and has all the features necessary to make operation simple and enjoyable.

Using the Program

The top few lines of the screen contain the fields that can be filled in when using the logging program. The data can be entered from the keyboard or the mouse. As soon as a station's call is entered into the ID field, a check is made of the log for a similar entry. If a match is found the information from the most recent matching entry is put onto the screen. This process takes only a few seconds because the complete log base is in memory at all times. As the QSO progresses all fields in the logger can be filled in and, when ready, a single command writes the log information to disk.

While in the normal mode, writing the log data to disk erases all the data fields, preparing the logger for the next entry. In the contest mode, the logger behaves differently. Fields that would not normally change (mode, band, power, RST, etc.) are not erased after being written to disk. This makes contest logging an easy task.

The use of a mouse shortens the number of keystrokes required to fill in the fields in the logger. In fact, it's possible to have a complete QSO or contest exchange, depending on how your buffers are loaded, without having to type in any information. If you point the mouse cursor to the field that you want data entered into, and then click the mouse after that data has been received and is on your screen, the data automatically goes into the log. As soon as a call is entered into the ID field, a dupe check is initiated. The call is also put into the call exchange buffer. This way, when the F4 key is pushed, the station you are working and your call are automatically sent. The ability to use a mouse is an important and unique feature of the Aries-1 software. It makes contest operating a real ease and day-to-day operation a snap.

> ***"(With a mouse), it's possible to have a complete QSO or contest exchange . . . without having to type in any information."***

Practice Makes Perfect

The technique needed to click the mouse at the right time to get the data you want entered into the logger takes a little practice. The mouse must be clicked after the data you want to enter is on the screen and a space has occurred, but before the next space occurs. In other words, when the mouse is clicked, the most recent letters between spaces are entered into the field you have selected.

Another useful function in the Aries-1 is what the authors call "replaceable string parameters." Using them lets you customize your stored buffers in a way that would make them seem as if you are entering them from the keyboard. For instance, one of the replaceable parameters is for the "Name" field in the logger. If you have a buffer stored that has the control code for "Name" in the proper place and you have entered a name in that field of the log, when that buffer is transmitted, the name is inserted in the proper place.

The log entry number is also a replaceable string parameter. During a contest you can have an automatically incrementing QSO number both for your log functions and to transmit as part of your exchange.

Log Management

The software also operates in a manual mode allowing you to use it as a logger alone. This feature enables you to use the package as your station logger regardless of the mode you are operating. Previously mentioned fields are supported in the manual mode. Additionally, the remainder of the screen becomes a scratch pad—anything typed will appear on the screen, a handy feature for CW QSOs.

The versatility of the log management module is hard to equal in other on-line logging programs. You can search the logs and create new logs with the results. You can change or delete records, and print logs in long or short form. These are just a few of the program's features. The log management section is also capable of creating outputs that are dBASE III compatible.

The original version of Aries that I received had a few faults in both the software and the manual. Most of those have since been corrected. Remaining shortcomings are the absence of a QSO buffer (one is promised in an upcoming version) and the inability of the contest logger to do any type of scorekeeping.

My station equipment consists of a Leading Edge D2 computer with a monochrome monitor, and an ICOM 751A which is not interfaced to the computer. Thus, I'm not able to comment on the appearance of the screen in color nor the part of the software that imports data from the radio. Ashton is currently working on expanding that portion of the software to include more control of the radio and additional memories.

Ashton's president is Tom Ashton NY2I. I have spoken with him several times and he is very interested on feedback concerning his product. He continues to update his software. Revisions are free during the first ninety days, and available at reduced rates thereafter.

During a recent RTTY contest I used this software to make and log over 300 QSOs. It performed flawlessly, is easy to use and lives up to its advertising claims 100 percent. It has been a welcome addition to my software collection.

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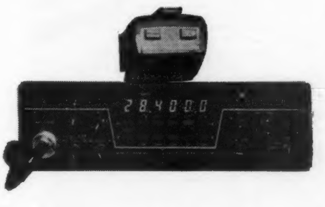

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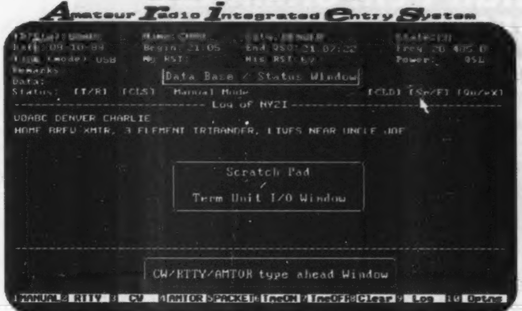

```
Date: 08-10-88      Begin: 21:05      End QSO: 21:07:22      Freq 28.405.0
[illegible] (mode) USB   My RST:      His RST: 59            Power:      QSL
Remarks
Data:                      Data Base / Status Window
Status:  [T/R]  [CLS]  Manual Mode                 [CLD] [Sn/F] [Qu/eX]
----------------------------- Log of NY2I -----------------------------
UOABC DENVER CHARLIE
HOME BREU XMTR, 3 ELEMENT TRIBANDER, LIVES NEAR UNCLE JOE

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                                 /
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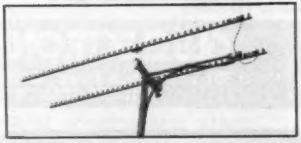

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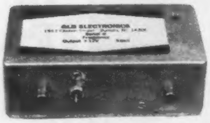

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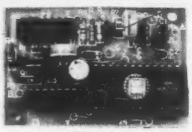

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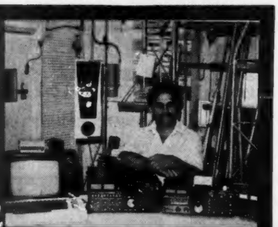

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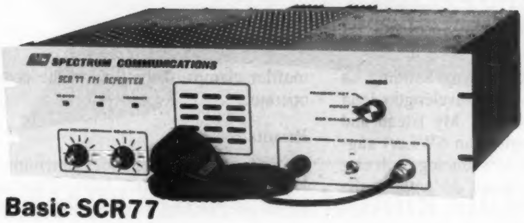

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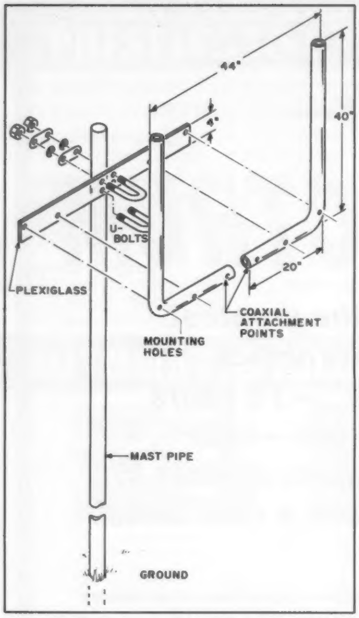
CIRCLE 51 ON READER SERVICE CARD

Number 11 on your Feedback card

Slingshot for Two

Big 2-meter signal for under $5.

by David Younker KA8OGD



Assembly of the 2-meter "Sling-shot" antenna.

I would like to be able to say that I ran a ream of calculations through my IBM PC to arrive at the design for this antenna, but I cannot. I used an abacus.

Actually, I was considering building an expanded quad loop—two wavelengths long but open at the top center. My friend and coworker Henry Higgins (an SWLer) suggested, however, that by reducing each element for ¾-wave, I could do without the matching network.

He was right. The radiation pattern changes, however, from bi-directional broadside to the loop to bi-directional in the plane of the vertical elements.

Construction Procedure

To build the two meter version, obtain a length of electrical conduit ten feet long. Cut the conduit in half and bend each length into the shape of an "L" with 20 inches on the short side and 40 inches on the long side. Have a person from the hardware store do the bending for you, or you may end up with collapsed bends, as I did.

Drill mounting holes as diagrammed, or work out your own arrangement. I bolted the antenna to a piece of Plexiglas™, but a length of painted wood will serve as well. Next, attach the antenna to the mast with a pair of muffler clamps. Then, attach the coax and operate.

Results

SWR on the sling-shot, untrimmed, is 1.5:1 across the top two MHz of the band. I get reliable coverage over a forty mile radius of the home base. Limited experimentation with a six meter version with KD8FW on the receiving end some sixty miles away gave better results than my two element beam at thirty feet (for operation on 2m).

With both the six and two meter versions, the horizontal section was a half wave or more above ground level. I have not tried any other elevations and will not until I put up the 15/10 meter job that I have planned for the summer. Fifteen meters would appear to be the upper limit for this design—after fifteen the dimensions begin to get unwieldy.

Total cost for the two meter version was under five bucks—$3.60 for the conduit and $1.30 for the muffler clamps. I already had the Plexiglas in the junk box.

My thanks for Charles Woods for his assistance with the diagram. ■

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FM Split for the Uniden HR2510

Modify this rig for easy 10m repeater operation!

by Richard Thomas WB9WDH and Thomas Dick WA9QDZ

In addition to surplus CBs that are easily modified for ten meter operation, there are many new quality inexpensive ten meter FM radios now on the market. One of the best examples of these new rigs is Uniden's President Model radio. It operates in AM, SSB, FM, and CW modes. It sells for about one third the cost of a regular ham-band transceiver. Its one notable drawback, however, is that its FM operation is not designed for the split frequency operation necessary for repeater operation. This article shows you how to modify the Uniden for easy split frequency operation.

Circuit Workings

Uniden opted to use one filter for receive and transmit, using switching diodes to go from one state to the other. Receive is turned on in all modes except FM with the diode D105. In the transmit mode, D105 is turned off and diodes D106, D120, and D109 are biased on, effectively isolating the filter (FT102) from the receive circuit and using it to filter SSB and AM transmit audio. In FM operation, no audio is passed through this filter. All this action takes place on the main board of the Uniden.

On the original model, modulation is done in the VCO on the microprocessor board. D1 and D2 of the new bypass filter that we use (Figure 1) turn on through radio parts R11, R18 and R13. RF flows through D1, C1, and D2 around the filter. DC passes through R1 and R2 of the bypass network to an 8 volt transmit source via the beep switch. The 10.6975 MHz frequency is passed through to the transmit mixer to derive the operating frequency.

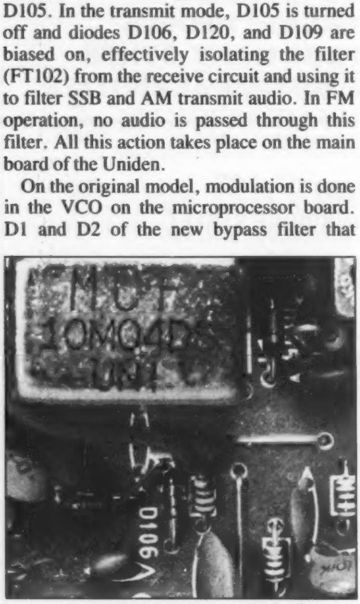

Photo A. Installation of the bypass section of the mod on the main board of the Uniden.

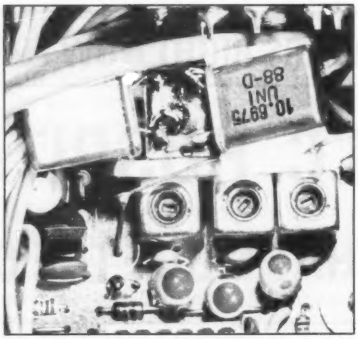

Photo B. Installation of the crystal and the relay. This is at the front of the Uniden, the left side as you face the rig.

In order to get the offset for repeater operation, we chose to change back and forth between the regular crystal at X101 (10.6975 MHz) and the new one (10.7975 MHz). The crystal shift is done with relay K1 and X101A (10.6975 MHz) and X101B (10.7975 MHz). X101B is 100 kHz higher, so when it is mixed in the transmit mixer, the difference in output is 100 kHz lower than the original crystal at the operating frequency. The K1 relay power is taken from the FM mode switch wire (brown wire) so that the relay is turned off in all modes except FM. This allows the relay to be energized when the beep switch is in the IN position, making offset operation possible. Take note that the beep switch must be in the OUT position for operation on SSB and AM. The OUT position also shuts off the offset crystal X101B for simplex operation on FM. The beep feature will be eliminated.

Before you try to modify the Uniden President, make sure it transmits and receives on the same frequency. This is called tracking. You can check for this problem on the air but be sure the RIT knob is absolutely vertical. If it does not transmit and receive on the same frequency, return it to Uniden for repair before making any modifications.

It takes very little to make the necessary changes: one crystal for 10.797.5 MHz, one subminiature DPDT DIP relay from Radio Shack (part #275-213A), and several resistors and ceramic capacitors. Total cost for all items should run less than $20. For another $15.75 plus postage you can get a service manual (part #SMHR2510) from Uniden (Sales Dept., 9319 Castelgate Dr., Indianapolis IN 46256). Let's take this modification step by step.

Dramatis Personae

First, order a crystal for 10.7975 MHz fitting the characteristics of a crystal for the Cybernet board (holder HC 18, PT#/OF = RMF-9, R.T. Tol. = 50 CL PF + 30 RS = 20). You can order the crystal from Crystek Corporation (PO Box 06135, Ft Myers FL 33906, PH: 800-237-3061.) While you are waiting, go to Radio Shack and get one relay (Radio Shack part #275-213A) plus any of the other parts you don't have around the ham shack (see Figure 1).

Build The Bypass

When the crystal comes you are ready to go to work. Disconnect the power cord from the rig. Remove the top and bottom covers by taking out the screws. Be sure that you don't have anything around the work area that could short out against components in the chassis. Build the bypass network as found in Figure 1 between D106 and D120 near FT102 (see Photo A). Make the leads between components as short as possible. Attach one wire about 8" long to the junction of R1/R2/C1. Connect the power cord and turn the radio on. Try to receive and transmit on SSB. If you wired everything correctly the radio should work. If it doesn't, don't proceed until you have cleared up the mistake.

Beep Switch Mod

Turn the radio off and unplug the power cord. We are going to modify the beep switch at this time. Locate the beep switch on the front panel of the radio. This will keep you properly oriented. Now remove the four

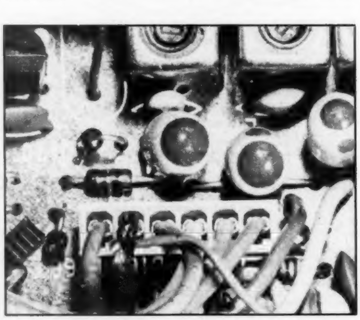

Photo C. Plug from the mode switch. The wire from pin 16 of the newly installed relay runs to the brown wire of this plug.

screws in the side of the face plate. This will allow the face of the rig to fall away. Pull it down as far as possible. Locate the back of the beep switch (Figures 2 and 3) and isolate all six landings of the switch by cutting the three trace runs with a sharp knife (see Figure 3). Brighten the copper foil around the switch landings so that it will take solder. Prepare four pieces of wire ten inches long, preferably in four different colors. Solder a wire to each of four landings: B1, B2, C1, & C2. Put the face of the rig back on. Insert the screws. Reattach the power cord and turn the rig on. The rig should still work on all modes.

Relay/Crystal Mod

Now turn off and disconnect the power cord again. Turn the rig upside down and locate the VCO assembly, which hides the solder leads for crystal X101. Remove the wires attached to VCO assembly. (Be sure to note where they go so that you can put them back.) Remove the whole VCO assembly and then unsolder crystal X101.

Turn the radio over on the other side. Mount the Radio Shack relay against the metal sides of the cans for L116, L118, and L117 (Photo B) using double-sided tape with the pins of the relay pointing away from the board and pins 1 and 16 facing toward the outside edge of board. Connect a wire from pin 13 of the relay to the empty hole of X101 that is farthest from the front of the rig. Connect a wire from pin 4 of the relay to the empty pin hole of X101 that is nearest to the front of the radio. Now replace the VCO assembly.

Next, connect a wire from pin 16 of relay to the brown wire of the plug from the mode switch. This plug is in the area of X101 in the left front corner of the main board (see Photo C). Connect a wire from C2 of the beep switch to pin 1 of the relay. Connect a wire from B2 of the beep switch to any good chassis ground. Connect a wire from B1 of the beep switch to resistor R93 on the side next to FT102 (Photo D). Connect wire C1 of the beep switch to the wire that is attached to the common junction of R1/R2/C1. Make the joined wires as short as possible and tape the solder connection carefully. Then solder the crystal removed from X101 to pins 11 and 6 of the relay. Solder the new crystal to relay pins 9 and 8, being careful not to short out any of the leads to the case.

Mod Checkout

Attach the power cord and turn on the rig. Check the voltage on the relay to see that it turns on and off when the beep switch is depressed and out. Set the LED readout for 29.000 MHz of your Uniden. With the beep switch out and the radio in the FM mode, key the transmitter and read the transmit frequency with a counter. It should be within 1 kHz or less of what the LED readout on the radio shows. If it isn't, you have made a mistake. Go back and check your work carefully.

If the transmit frequency is not the same as that indicated by the readout (but within 1 kHz), adjust L117 to obtain the same frequency as that displayed by the LED readout. Put the radio in lower side band (LSB) mode. Set the RIT in the dead center position, i.e. the vertical or the 12 o'clock position. Generate a signal with a 100 kHz generator like that found in older analog ham receivers. Bring the radio close enough that the signal can be heard in your Uniden radio. Zero beat the Uniden radio with this signal using L118. It should take no more than one turn. Then change the rig to upper side band (USB) mode. Zero beat again using L116. This reestablishes receiver tracking.

That concludes the modification of the radio. Replace its covers. The beep switch must be out to transmit on AM or Side Band, and for FM simplex. The beep switch should be depressed when you want to transmit on the offset frequency characteristic of ten meter repeaters.

Postscript

We suggest one additional modification for the operator who switches from one mode to another frequently and may forget to reset the beep switch. The installation of an additional relay identical to the one already used will help to reduce the chance of operator error for the true purist. It disables the bypass function when the mode switch is in any position other than FM. The relay coil for this new relay should be connected in parallel to the other relay coil that switches the X101 crystals. You can use either pair of normally open contacts of this relay. They should be connected in series with the power lead that runs from the bypass network to the beep switch. The mounting of this relay is not critical.

Here's hoping to satisfy all those 10 FM repeater users out there who wanted to buy this fine and inexpensive radio, but held off because there was no easy split operation on it. Now there is—

Enjoy!

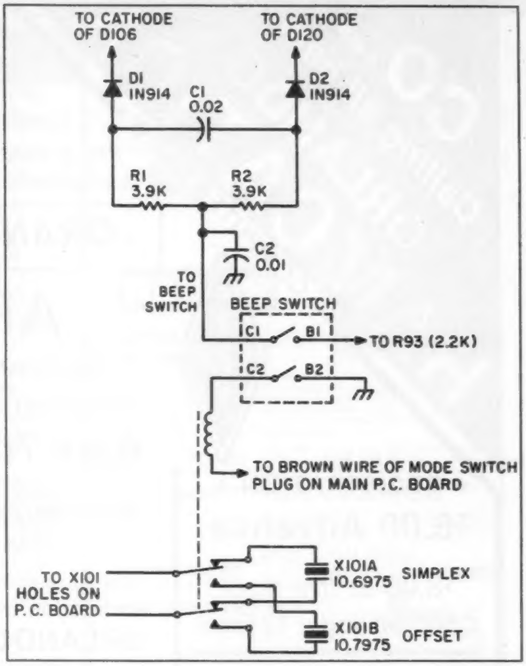

Figure 1. Schematic for the modification to the Uniden President 10m rig for easy repeater operation.

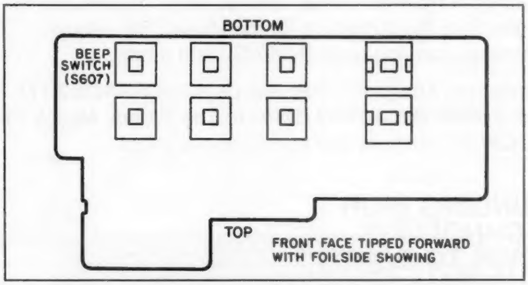

Figure 2. Board in the Uniden toward the front panel, on which the beep switch sits.

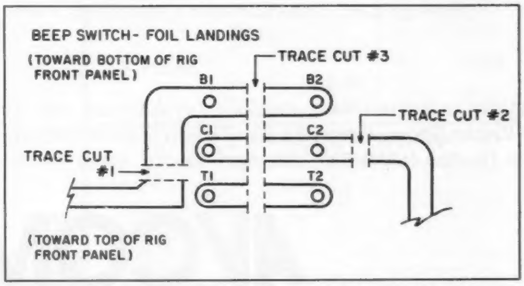
BEEP SWITCH- FOIL LANDINGS
(TOWARD BOTTOM OF RIG FRONT PANEL)
TRACE CUT #3
B1
B2
TRACE CUT #2
C1
C2
TRACE CUT #1
T1
T2
(TOWARD TOP OF RIG FRONT PANEL)

Figure 3. Close-up of the foil landings for the beep switch. You need to cut three traces to modify this switch to have it switch on and off the split feature.

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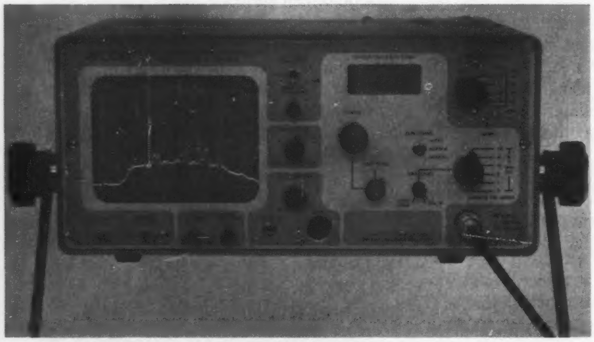

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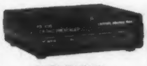

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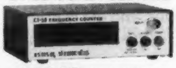

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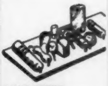

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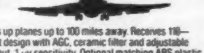

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CIRCLE 34 ON READER SERVICE CARD

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73 Review by Alan C. Merrill W1FYR

Delta Loop Antennas, Inc.
12 Brush Drive
New Fairfield, CT 06812
Price Class: $300

The Delta Loop DL-102

Take advantage of the versatile 10-meter band.

A seven foot box arrived by UPS one sunny fall afternoon. "Ha!" said I, "My new 10 meter Delta Loop beam!" Hearing this, my XYL said, "What, another antenna? You already have ten, how come you need another one?" I said, "M'love, you grossly exaggerate!" (I really only have nine.) "But this is special. . ." And at the time, I really did not know how true that statement was.

Mil-Spec

The thing that impressed me the most upon opening the box was the overall high quality of the unit. This antenna is built to last. As I continued to build the unit, this fact became even more obvious. For example, all of the tubing is 6061-T6 aluminum. There are no castings, and all the hardware is mil-spec stainless steel. This is perhaps to be expected, as Bob Hobert KA1UJ, the President of Delta Loop Antennas, Inc., has a great deal of experience in building aircraft and missile parts.

The Delta Loop

What is the DL-102? By definition, it is a V-shaped beam, commonly called the Delta Loop, with the element tips connected together with copper wire. The boom supports the "arms (elements)." The Delta Loop is not a new idea. The 1970 edition of the *ARRL Antenna Book* discusses it in some detail, giving dimensions for a number of the HF bands.

In this version, the elements are attached to the boom (5' long) by heliarc welded element "horn" clamps. A mast mounting bracket attaches the boom to the supporting mast. The manufacturer recommends using 1½" ID galvanized water pipe for the mast, and the bracket is designed to accept this.

The bracket also has two sets of holes drilled to allow U-bolt mounting if you don't want to go with the 2" OD water pipe. That 2" OD water pipe is great stuff, but it is heavy. I will probably use it on my permanent installation as it is reasonably priced and generally available at plumbing stores.

The antenna exhibits the same general broadband characteristics and electrical properties as full-wave loop antennas such as the quad. Some of the other interesting specifications are weight: 21 lbs., element arm length: 12 ft., boom length: 5 ft., turning radius: 7 ft., surface area: 2.9 sq. ft., and element spacing: ⅛ wavelength. It also has an adjustable gamma match with a rating of 2 kW, a 50Ω input impedance, and an SWR at resonance of 1.1:1. The gamma match is factory pretuned and wired. All you need to do is connect your coax to the bracket.

Tunerless Operation

The factory setting was just about right for my location. My solid state rig liked much of the 10-meter band, with the protective SWR circuit only shutting it down on the last 500 kHz of the upper band edge. On the lower end, at 28.000, we saw only 1.6 to 1. At 28.200, we were looking at an SWR of 1.2 to 1. From 28.200 to 28.700 it was a nice 1.1 to 1. At 29.000 it was 1.6 to 1. I suspect most solid state rigs would handle a large part of the 10 meter band without an antenna tuner. My older Kenwood 820S with a tube final took the entire band in stride.

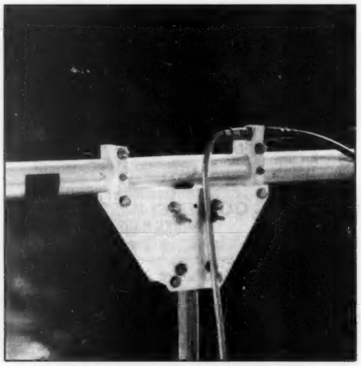

Photo A. The five-foot boom and mast mounting bracket, showing the clamp for the coax and the overall sturdy construction.

Full wave antennas are supposed to be broadband, and this one certainly is. The gamma is easily adjustable, so you can favor one end of the band or the other, and the way to do this is clearly spelled out in the instructions.

Performance

An antenna can look like a million bucks but unless it performs for you, you might as well go back to a wire dipole. As a quick comparison, the DL-102 outperformed my tribander, which is up a lot higher. And, of course, it left a ground-mounted vertical in the dust. The Delta Loop consistently gave us about two to three S-units over the tribander on both transmit and receive.

The first call I gave on ten meter AMTOR brought a W6 back to me with a 589 report. On the next call on AMTOR I found a W7 maritime mobile in the area of Colon, Panama. We had a great chat for about an hour. All this when ten was only marginally open! My subsequent experiences with this great antenna were no less satisfying.

Photo B. The boom, with the heliarc welded, heat treated, element "horn" clamps that support the "V" arms. The black cable connects between the coax support and the gamma match, which is prewired.

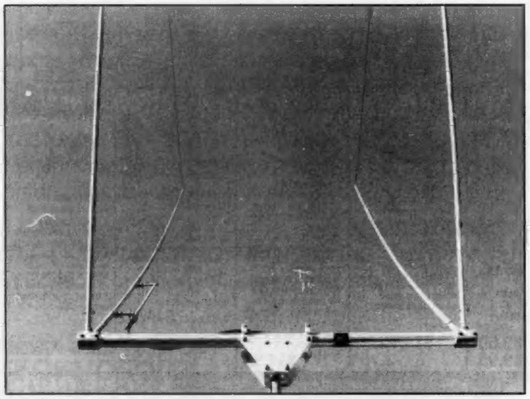

Photo C. The full antenna showing the elements and the copper wire connecting the upper end of the elements.

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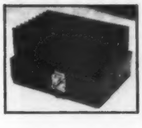

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CIRCLE 81 ON READER SERVICE CARD

73 in 1988

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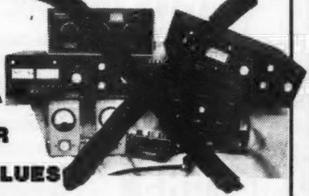

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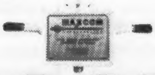

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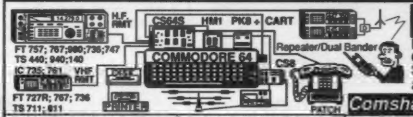

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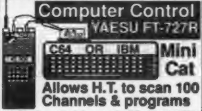

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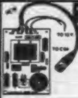

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CIRCLE 343 ON READER SERVICE CARD

How about back-to-front? It is a two-element beam. From all I could see, it performed as well as or better than most of its horizontal-element ilk. Though S-meters at best give you a rough comparison, I was happy to see several S-units difference as the beam was swung 180 degrees. As the null on the side of the beam was reached, I just about lost the weaker signals, and others dropped several S-units, all of which was about what I expected from a beam with a driven element and a reflector. Typical performance for well-designed loop antennas should be 6 to 7 dB forward gain, and a front-to-back of around 20 dB. Any given field situation may show a vast difference from these "typical" figures. Gain figures are rather illusive and, unfortunately, can be made to say most anything you want them to, depending upon how you measure them. The bottom line is that the old saw about "the proof of the puddin' is in the eatin" certainly holds here. The "eatin" was good!

Withstands the Elements

The Delta Loop has weathered several ice storms here in southern New Hampshire, and has come through them with flying colors. I suspect that, because of the "V" shape of the elements, this beam's ability to withstand rotten weather is probably very good to excellent. Another nice feature of the DL-102 is that it has a surface area of only 2.9 square feet, which means it can be rotated by a good TV rotator or by a lightweight ham unit such as the Alliance U-110.

A Picture Says 1000 Words

My only complaint was with the instruction sheet. The pictures of the beam for construction purposes were not good—it was difficult to see many details. Being a visual type person rather than a verbal type, at least in putting things together, I found this annoying. Also, a sheet with line drawings of the various parts, with labels, would have made things easier. Nevertheless, it is a very easy beam to put together and the written instructions were very complete, so this complaint is certainly a minor one. In a recent conversation with the President of Delta Loop Antennas, Inc., I was advised that the new printing of the instruction sheet will correct the photograph problem.

One very nice thing about the beam was the machining. All parts fit perfectly! I did not have to re-drill or re-bore any holes. I probably spent a little over two hours, with time out for coffee breaks, telephone calls, and chats with my XYL.

During the next several years, as Solar Cycle 22 peaks and then begins to wane, 10 meters is going to be a great band to work, with its variety of legal modes. I remember past solar cycle peaks when we were routinely "working the world" on 10 meters and running relatively low power. Don't miss out on the fun!

An A1 Antenna

To sum it all up, if you are serious about ten meters, this is the beam for you. And from the way it is built, it should last well into Solar Cycle 25! ■

73 Review by Jim Gray W1XU

Austin Suburban Tribander

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Price Class: $70

How would you like a slim, small, easily-erected antenna that covers the three most-used VHF/UHF bands? The Austin Custom Antenna "Suburban Tribander" may be exactly what you've been looking for, if you haven't already found it.

This unique antenna covers the 2 meter, 223 MHz, and 440 MHz amateur bands with a very low VSWR. The Tribander covers these three bands with a single feedline of 50Ω characteristic impedance. Obviously, if you have three separate radios, you will have to use a coaxial switch to select the radio you intend to use. A better arrangement might be one of the new duo-banders covering these two bands. Those of you who may still have the Drake VHF-UHF triband rigs available will find this antenna ideal.

> *"(The antenna) can be easily removed, yet will never come loose by itself."*

The Suburban Tribander is vertically polarized and consists of half-wavelength radiating elements protected by an attractive "radome" of PVC plastic. The dimensions are such that you can use it either for a fixed station installation or on your automobile, since it measures less than four feet in length and less than an inch and a half in diameter. The weight is negligible. The antenna is a civilian version of similar antennas designed for military and government use, and has the desirable features of simple, economical mounting and excellent weather protection.

One feature I've never seen before is the tapered "sleeve" mounting system used here. There is a two-foot-long stainless steel mounting tube inside which the base of the antenna makes a sliding fit. It can be easily removed, yet will never come loose by itself. The sleeve can be bracketed to your support pole by either U-bolts or by hose clamps (as in my case), or even by a pair of angle pieces welded back-to-back along their angles.

Form An Attachment

Austin will supply mounting hardware if you need it, including bumper mounts with stainless steel straps, ratchet lay down for marine antennas, bulkhead stand off for marine antennas, and stainless steel scroll clamps. In addition, you can order a magnetic mount fitted with an SO-239 and Motorola Type ¾" thru hole SO-239 fitting, a male quick disconnect stud for 500SS/FG series mounts, and a large male quick disconnect for the "stick." Austin also provides a variety of low-loss cables.

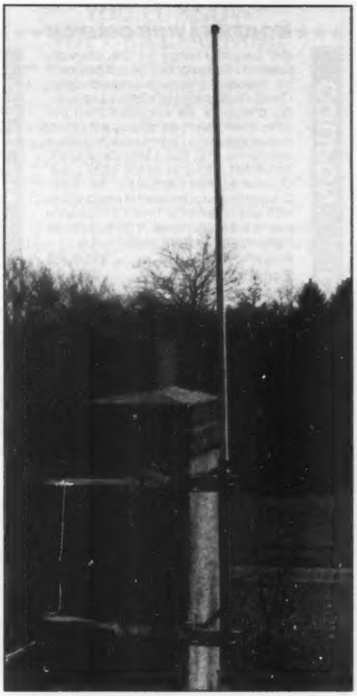
The Suburban Tribander is a ground-independent antenna on all three bands, and provides an angle of radiation of 1 degree or less above the horizon. The VSWR was less than 1.35:1 on all bands, measured at the center frequency. The mobile version, called the Metropolitan, uses the vehicle body for decoupling, and a 4 MHz bandwidth is achieved on all bands. Its performance equals or exceeds that of a half-wave dipole.

Shack Test

I mounted the Suburban Triband antenna at the top of a 30 foot telescoping TV type mast, using a pair of hose clamps to secure it near the top. No pretuning was required. I connected a long piece of RG-58 cable that happened to be handy and had been used for other antennas I've used in the past. Unfortunately, I didn't have a 220 MHz rig to try that band, but I can certainly vouch for its fine performance on both 440 MHz and 2 meters.

The antenna support is nearly surrounded by pines rising to 60 feet or more. In addition to that, my QTH is approximately 75 miles to the test repeater, one which covers both bands.

Although my elevation is about 5,000 feet above sea level, there are nearby mountains rising to 7,000 or more feet ASL, some of which block the antenna in the directions that I want to use. Not to worry. The Surburban Tribander was able to bring up both the 147.36 machine's and the 444.5 machine's full quieting into the receiver—this with a transmit power as low as 2 Watts!



The Austin Suburban Tribander 2m/1.25m/70cm antenna.

I then tried the impossible—or so I thought—by tuning to the input of a repeater behind the mountains and 100 miles distant. To my surprise, I brought it up with no difficulty on 2 meters (scratchy reception) though not at all on 440 MHz. That didn't surprise or discourage me in the least, as I need an 11-element beam to provide solid signals to and from that location.

Go For It

Do I recommend this antenna? You bet! The Suburban Tribander is a simple, high-performance antenna that will yield excellent performance for years to come. ■

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P210-T *Regency* 40 channel CB Mobile	$56.95
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P300-T *Regency* 40 channel SSB CB Mobile	$137.95
P400-T *Regency* 40 channel SSB CB Base	$174.95
PR100-T *Regency* visor mount radar detector	$54.95
PR110-T *Regency* "Passport" size radar detector	$114.95
PR120-T *Regency* "micro" size radar detector	$144.95
MP5100XL-T *Regency* 40 Ch. marine transceiver	$139.95
MP5510XL-T *Regency* 60 Ch. marine transceiver	$159.95
MP6000XL-T *Regency* 60 Ch. marine transceiver	$209.95
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Regency® RH256B-T

List price $799.95/CE price **$299.95/SPECIAL**

16 Channel • 25 Watt Transceiver • Priority

The *Regency* RH256B is a sixteen-channel VHF land mobile transceiver designed to cover any frequency between 150 to 162 MHz. Since this radio is synthesized, no expensive crystals are needed to store up to 16 frequencies without battery backup. All radios come with CTCSS tone and scanning capabilities. A monitor and night/day switch is also standard. This transceiver even has a priority function. The RH256 makes an ideal radio for any police or fire department volunteer because of its low cost and high performance. A *60 Watt* VHF 150-162 MHz. version called the **RH606B-T** is available for $429.95. A UHF 15 watt, 16 channel version of this radio called the **RU156B-T** is also available and covers 450-482 MHz. but the cost is $454.95.

★★★ *Uniden CB Radios* ★★★

The *Uniden* line of Citizens Band Radio transceivers is styled to compliment other mobile audio equipment. Uniden CB radios are so reliable that they have a two year limited warranty. From the feature packed PRO 810E to the 310E handheld, there is no better Citizens Band radio on the market today.

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PRO330E-T *Uniden* 40 Ch. Remote mount CB	$104.95
PRO500D-T *Uniden* 40 Channel CB Mobile	$38.95
KARATE-T *Uniden* 40 channel rescue radio	$53.95
GRANT-T *Uniden* 40 channel SSB CB mobile	$166.95
MADISON-T *Uniden* 40 channel SSB CB base	$244.95
PC122-T *Uniden* 40 channel SSB CB mobile	$119.95
PRO510XL-T *Uniden* 40 channel CB Mobile	$38.95
PRO520XL-T *Uniden* 40 channel CB Mobile	$56.95
PRO530XL-T *Uniden* 40 channel CB Mobile	$79.95
PRO540E-T *Uniden* 40 channel CB Mobile	$97.95
PRO640E-T *Uniden* 40 channel SSB CB Mobile	$137.95
PRO710E-T *Uniden* 40 channel CB Base	$119.95
PRO810E-T *Uniden* 40 channel SSB CB Base	$174.95

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RD9-T *Uniden* "Passport" size radar detector	$114.95
RD9XL-T *Uniden* "micro" size radar detector	$144.95
RD25-T *Uniden* visor mount radar detector	$54.95
RD500-T Uniden visor mount radar detector	$74.95

Bearcat® 200XLT-T

List price $509.95/CE price **$254.95/SPECIAL**

12-Band, 200 Channel • 800 MHz. Handheld Search • Limit • Hold • Priority • Lockout

Frequency range: 29-54, 118-174, 406-512, 806-956 MHz. Excludes 823.9875-849.0125 and 868.9875-894.0125 MHz.

The *Bearcat* 200XLT sets a new standard for handheld scanners in performance and dependability. This full featured unit has 200 programmable channels with 10 scanning banks and 12 band coverage. If you want a very similar model without the 800 MHz. band and 100 channels, order the **BC 100XLT-T** for only $189.95. Includes antenna, carrying case with belt loop, ni-cad battery pack, AC adapter and earphone. Order your scanner now.

Bearcat® 800XLT-T

List price $549.95/CE price **$259.95/SPECIAL**

12-Band, 40 Channel • No-crystal scanner Priority control • Search/Scan • AC/DC

Bands: 29-54, 118-174, 406-512, 806-912 MHz.

The Uniden 800XLT receives 40 channels in two banks. Scans 15 channels per second. Size 9¼" x 4½" x 12½." If you do not need the 800 MHz. band, a similar model called the **BC 210XLT-T** is available for $178.95.

Bearcat® 145XL-T

List price $189.95/CE price **$94.95/SPECIAL**

10-Band, 16 Channel • No-crystal scanner Priority control • Weather search • AC/DC

Bands: 29-54, 136-174, 406-512 MHz.

The *Bearcat* 145XL is a 16 channel, programmable scanner covering ten frequency bands. The unit features a built-in delay function that adds a three second delay on all channels to prevent missed transmissions. A mobile version called the **BC560XLT-T** featuring priority, weather search, channel lockout and more is available for $94.95. CEI's package price includes mobile mounting bracket and mobile power cord.

President® HR2510-T

List price $499.95/CE price **$239.95/SPECIAL**

10 Meter Mobile Transceiver • Digital VFO Full Band Coverage • All-Mode Operation Backlit liquid crystal display • Auto Squelch RIT • Preprogrammed 10 KHz. Channels

Frequency Coverage: 28.0000 MHz. to 29.6999 MHz.

The *President* HR2510 Mobile 10 Meter Transceiver made by Uniden, has everything you need for amateur radio communications. Up to 25 Watt PEP USB/LSB and 25 Watt CW mode. Noise Blanker. PA mode. Digital VFO. Built-in S/RF/MOD/SWR meter. Channel switch on the microphone, and much more! The HR2510 lets you operate AM, FM, USB, LSB or CW. The digitally synthesized frequency control gives you maximum stability and you may choose either pre-programmed 10 KHz. channel steps, or use the built-in VFO for steps down to 100 Hz. There's also RIT (Receiver Incremental Tuning) to give you perfectly tuned signals. With receive scanning, you can scan 50 channels in any one of four band segments to find out where the action is. Order your HR2510 from CEI today.

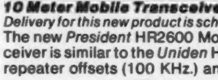
NEW! President® HR2600-T

List price $599.95/CE price **$299.95/SPECIAL**

10 Meter Mobile Transceiver • New Features

Delivery for this new product is scheduled for June, 1989.

The new *President* HR2600 Mobile 10 Meter Transceiver is similar to the *Uniden* HR2510 but now has repeater offsets (100 KHz.) and CTCSS encode.



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800 MHz.
mobile scanner
SPECIAL!

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XE550-T *Uniden* Cordless Phone	$79.95
XE300-T *Uniden* Cordless Phone	$69.95

★★★ *Extended Service Contract* ★★★

If you purchase a scanner, CB, radar detector or cordless phone from any store in the U.S. or Canada within the last 30 days, you can get up to three years of extended service contract from Warrantech. This service extension plan begins *after* the manufacturer's warranty expires. Warrantech will perform all necessary labor and will not charge for return shipping. Extended service contracts are not refundable and apply only to the original purchaser. A two year extended contract on a mobile or base scanner is $29.99 and three years is $39.99. For handheld scanners, 2 years is $59.99 and 3 years is $79.99. For radar detectors, two years is $29.99. For CB radios, 2 years is $39.99. For cordless phones, 3 years is $34.99. Order your extended service contract today.

OTHER RADIOS AND ACCESSORIES

BC55XLT-T *Bearcat* 10 channel scanner	$114.95
BC70XLT-T *Bearcat* 20 channel scanner	$159.95
BC175XLT-T *Bearcat* 16 channel scanner	$156.95
R2060-T *Regency* 60 channel scanner	$149.95
TS2-T *Regency* 75 channel scanner	$269.95
UC102-T *Regency* VHF 2 ch. 1 Watt transceiver	$114.95
BPS5-T *Regency* 16 amp reg. power supply	$179.95
BP205-T Ni-Cad batt. pack for BC200/BC100XLT	$49.95
B8-T 1.2 V AA Ni-Cad batteries (set of eight)	$17.95
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CIRCLE 121 ON READER SERVICE CARD

Continued from p. 14

tion for protection against corrosive atmospheres, such as air containing salt and industrial pollutants.

The 28 MHz operation could be improved by further "pruning" of the helically wound portion to achieve a low VSWR at resonance, and at the 50-foot elevation. This is something to take into account at installation. Resonant frequency at 28 MHz may vary by as much as 100–200 kHz between ground adjustment and elevated installation, particularly as inductively-loaded whips (such as the short, helically-wound antenna) have typically narrow bandwidths around their determined center frequencies. For narrowband antennas, height makes a very big difference in resonant frequency. Of course, the discone itself, without the vertical whip, needs no tuning or pruning whatsoever.

The Verdict

Hams, CBers, law enforcement agencies, utility stations, businesses, and military groups will find the Supercone a very useful antenna. The Supercone is an attractive and useful adjunct to any station particularly interested in covering the VHF and UHF portions of the radio frequency spectrum. We believe it performs satisfactorily over a wide band of frequencies for both transmitting and receiving in the VHF/UHF bands up to 1.3 GHz. The price of the Supercone, which includes a whip antenna for 28 MHz, is reasonable, considering the antenna's light weight, rugged construction, small size, low end-loading, and overall performance. ■

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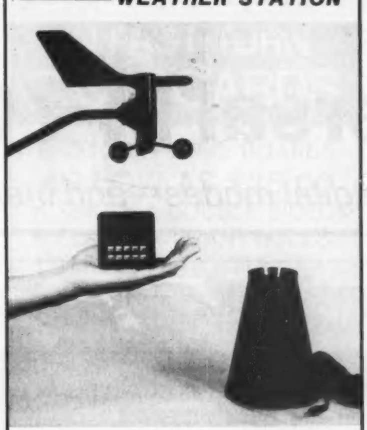

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All amplifiers are linear (all-mode), automatic T/R switching with adjustable delay and usable with drive levels as low as ½ Watt. We incorporate thermal shutdown protection and have remote control capability. All units are designed to ICAS ratings and meet FCC part 97 regulations. Approx. size is 2.8 x 5.8 x 10.5" and weight is 5 lbs.

Consult your local dealer or send directly for further product information.

SPECIFICATIONS

Model	Freq. MHz	Power Input	Power Output	Preamp NF-dB	Preamp Gain-dB	DC +Vdc	Power A	RF Conn.
0508G	50-54	1	170	6	15	13.6	28	UHF
0510G	50-54	10	170	.6	15	13.6	25	UHF
NEW! 1409G	144-148	2	160	.6	15	13.6	25	UHF
1410G	144-148	10	160	.6	15	13.6	25	UHF
1412G	144-148	30	160	.6	15	13.6	20	UHF
2210G	220-225	10	130	.7	12	13.6	21	UHF
2212G	220-225	30	130	.7	12	13.6	16	UHF
4410G	420-450	10	100	1.1	12	13.6	19	N
4412G	420-450	30	100	1.1	12	13.6	19	N

Models also available without GaAs FET preamp (delete G suffix on model #). All units cover full amateur band – specify 10 MHz bandwidth for 420-450 MHz amplifier.

Amplifier capabilities: 100-200 MHz, 225-400 MHz, 1-2 GHz, Military (28V), Commercial, etc. also available – consult factory.

TE SYSTEMS

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CIRCLE 232 ON READER SERVICE CARD

Number 15 on your Feedback card

73 Review

by Peter Ferrand WB2QLL

The Universal M-7000

Universal Radio
1280 Aida Drive
Reynoldsburg OH 43068
PH: (614) 866-4267
Price Class: $1,000

Decodes all standard digital modes—and then some.

Part of the magic of radio has always been exploring the frequency spectrum, just turning the dial and not knowing what you will hear next, or from where in the world it will come. It's the magic of seeking out new knowledge, and the challenge of a hunt requiring luck, skill, and perseverance. The result is a fascination with amateur radio that began for many of us as a kid playing with a shortwave receiver.

UNIVERSAL
M-7000
COMMUNICATIONS TERMINAL

Photo A. Fore . . .

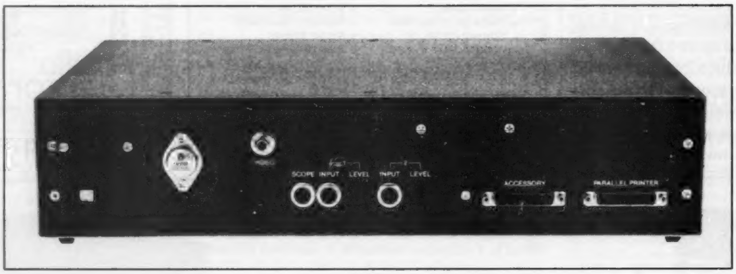

Photo B. . . . and aft of the M-7000.

The Spirit of Challenge

You won't find much of that spirit with a 2 meter HT, and digital radios and million Watt transmitters have made most shortwave broadcasting mundane, but the spirit of challenge and discovery comes to life with the Universal M-7000.

The M-7000 is a communications terminal capable of receiving almost any standard digital mode on the air, including several that you have probably never heard of (see Figure 1).

You won't be able to make sense out of all the noises on the dial, for many are encrypted, and many more are not text or pictures, but if you're fascinated with finding new stations, the M-7000 has ample tools to pick out almost any signal. You can display Russian text in Cyrillic, nonprinting RTTY codes, such as line feeds, and if all else fails, you can display signals in binary (yes, with ones and zeros on the screen).

Stations around the world available with the M-7000 include marine and diplomatic traffic, news services, facsimile weather and news photos, military communications, and of course, amateur radio.

One of a Kind

The M-7000 is the only machine available that combines all these modes. Fred Osterman, the owner of Universal Radio, says that commercial and military users constitute many of the buyers of the M-7000. The M-7000 is ideally suited for training operators in varied modes.

The M-7000 combines the features of several previous DES units into one unit with added functions, while maintaining the same overall design and operational philosophy. I have owned half a dozen of the previous units, and the M-7000 represents a step forward in all respects.

> **"Diversity reception is a unique feature of the M-7000."**

The complexity presented by two 16-button keyboards and an array of lights and switches is a consequence of the designers' decision to allow the operator as much flexibility as possible. Each of the buttons on the keypad is dedicated to two functions, one normal and the other shifted, controlled by a shift toggle switch on the front panel.

Other functions are controlled by other toggle switches, and LEDs provide information on signal strength, decoding, and errors. A program mode allows you to change system constants, such as interfacing, printer parameters, selective calling, and memories, as well as diagnostics and calibration.

Complete Documentation

All of this is very well explained by the two manuals that come with the M-7000. The first is "Getting Started," written by Osterman. The other is a reference manual so complete it even has schematics and alignment instruction (Hooray!). A reference card is included (see Figure 2), and that information is duplicated on the help screen.

The manuals confirm that those who are unwilling to read them will not be able to take advantage of the M-7000's versatility. Even so, it only takes a few minutes with the "Getting Started" manual for you to begin receiving digital transmissions. Once the unit has been set up for a particular signal, the setup can be repeated the next time.

Getting Started

There are two time-consuming aspects to operating the M-7000, and both are a reflection of the hobby itself. First, in order to use all the control functions, you need at least a rudimentary understanding of the principles behind the mode you are trying to copy. Sufficient information is in the manuals, but it takes some experience, too.

The second aspect involves the nature of the transmissions. The "Getting Started" manual provides a terrific head start by listing frequencies and mode settings for an assortment of stations transmitting in all the modes the M-7000 is capable of receiving. In theory, all you have to do is set up your receiver and let the M-7000 soak up all the neat information. But frequency and mode listings aren't enough. Most of the transmissions are directional for point-to-point services, and frequen-

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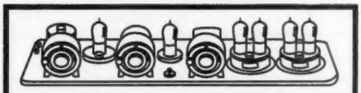

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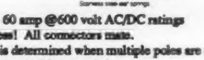
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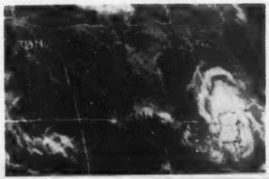

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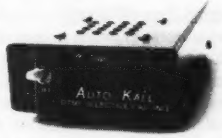

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SPECIFICATIONS

Modes & Speeds:

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Packet	300 & 1200 Baud (AX.25)
Baudot	45, 50, 57, 75 & 100 Baud Plus variable non-standard rates from 30 to 251 Baud in 2 baud increments.
Sitor	Mode A (ARQ) and Modes B (FEC collective and selective) - 100 Baud (with ALTOR automatic feature)
ARQ Moore	2 channel TDM 86, 96 & 100 Baud 4 channel TDM 172, 192 & 200 Baud
ARQ-E	ARQ-E 48, 64, 72, 86, 96, 144 and 192 Baud.
ARQ-E3	ARQ-E3 48, 64, 72, 86, 96, 100, 192 and 200 Baud.
Morse	5 to 120 wpm auto ranging (in 3 ranges)
Bit Inversion	Baudot based codes only - decodes any combination of bit inversions.
Three Shift Cyrillic	Available in Baudot and Baudot-based codes (video display only).
Literal Display Mode	ASCII, Baudot, SITOR and ARQ in all speeds available in these modes (video display)
Databit Display Mode	Synchronous and Asynchronous from 30 to 251 bauds.
Filter Tones	High tone (mark = 2125), Low tone (mark = 1275) fixed shifts of 60, 85, 170, 425, 850, and 1200 Hz. are provided, plus a variable function

Figure 1. M-7000 Specifications.

cies vary with days of the week, propagation, and interference. Listings go out of date quickly as stations change schedules, frequencies, and modes to suit the needs of what is usually a very narrow audience. Some of these channels will only have traffic on them for a few minutes a day, and sometimes they will transmit an idle signal for hours at a time.

Even digital radios don't read out the same frequencies when offset into the sideband or RTTY modes, and some listings are reported in USB and some in LSB, so there is always a possibility of signals plus or minus 3 kHz.

Figuring Out the Mode

The real challenge, of course, is figuring out what's being sent by a signal you stumble upon as you tune around the dial. This is a trial and error process which requires practice as you learn to determine by ear which mode is being used. Osterman says he's working on a tutorial cassette tape of the sounds of the various modes, which will save you days of empirical learning.

To some degree, the M-7000's computer helps by having a mode in which it finds the shift and speed of a RTTY signal. It can select automatically between SITOR A and SITOR B. For the more arcane modes, the error and data LEDs signal when a station is tuned in. All of these, however, can be fooled.

The M-7000 also receives FAX transmissions and works almost identically to the Info-Tech M-800 which I previously reviewed for *73 Amateur Radio.* Video FAX is an option which, though providing screen resolutions far inferior to what the M-7000 will produce with a printer, is of great benefit in setting up the equipment and checking out signals without wasting a lot of paper.

You may be surprised to find your two-way ham operations enhanced with the M-7000. It's easy to run receiver audio to both the M-7000 and your RTTY unit, or better yet, to a separate receiver. The nature of RTTY reception is such that one will usually work better than the other, and the M-7000 offers much more opportunity for tinkering with adjustments.

Diversity reception is a unique feature of the M-7000. The unit accepts audio from two different receivers, which should be connected to two different antennas. The M-7000 switches between the two receivers, depending on which is stronger. The theory is that signals will not fade on both antennas at the same time.

Sometimes it helps and sometimes (especially with a high noise environment) it doesn't, but diversity reception is fascinating to watch. You should try it, especially if you want accurate copy over long periods.

Connections and Interactions

The basic hookup of the M-7000 is simple. It needs audio from a receiver and it supplies video to a composite CRT video display. Digital modes are critical, and quality counts. A high quality receiver makes a big difference, and a high quality monitor and double-shielded coax will reduce noise.

The M-7000 can accommodate either a serial or parallel printer, but FAX operation requires an Epson compatible parallel printer. For careful tuning, especially of the more complex modes, an oscilloscope is almost essential. Any conventional audio or RTTY monitor scope can be hooked up to the M-7000.

You can easily control nearly all the M-7000 functions by sending it an ASCII code from your computer. You can transfer data from the M-7000 to your computer in ASCII text as well, of course. You can save data in ASCII text files in your computer's hard disk drive or on floppy disks, and read, edit, or print them out later. Any communication program will suffice for M-7000 control and data transfer, as will any computer, as long as it has an RS-232 compatible port.

Besides the ability to save your data, control with a personal computer allows you to program the M-7000 for your favorite modes. There are 10 memories built into the M-7000 which are accessible through the keypad, but you'll probably want to set up many more with your computer. You can even send the M-7000 a code that transfers the status line settings and time of day to the computer so that you don't have to write down the settings. The status line can always be displayed at the bottom of the video monitor's screen.

You could write a short program to control the M-7000, or you could try one of the many programs available that allow sequences of keyboard characters to be programmed with a single key press.

Problems and Solutions

The only flaw of the M-7000 I've discovered in about a half a year of use is a slight amount of RFI from the computer circuitry in the unit. I've heard much worse from other gear, but I was very surprised that the noises were readily receivable, especially between 10 MHz and 20 MHz.

An antenna with a shielded feedline located some distance from the shack would likely solve the problem. The only trouble with that, however, is that I've always used open-wire feeders as the simplest way to get all-band operation into a city lot. You must use shielded video and printer cables to reduce other RFI problems.

The standard 16-button keypad saves money and provides control flexibility, but you have to constantly check the reference card to remember what does what, unless you have a gifted memory or have been using the M-7000 a long time. Keypads with easily changeable labels would be wonderful. Using a computer to set up the M-7000 with macro commands is a way around this.

Universal provides good service, a newsletter for purchasers, a computer bulletin board exchange of station loggings, and firmware updates as new functions are developed. I must quibble a bit about the price of the updates. While I appreciate them, at $70 a single ROM chip, they do add up.

The M-7000 gives you the chance to have fun listening to what the rest of the world is up to. You feel a real sense of accomplishment when you print out a station for the first time. Also, you'll have something else to talk about the next time you're on the air.

ALTERNATE

BI Manual	Frame Left Auto Sync	Frame Right Manual Sync	ARQ-E3
BI Automatic	Bit/Char Up		
Split Screen	Bit/Char Down		ARQ-E
Databit Display	Literal Display	Program	Help

1	2	3	Mark Freq.
4	5	6	Space Freq.
7	8	9	Shift
	0	Baud	

LEFT KEYBOARD

RIGHT KEYBOARD

NORMAL

SRO Line/Gray	Status Print	Screen Print	CW
Speed Up	Scroll Up	UOS/PAR IOC	SITOR
Speed Down	Scroll Down	Case Change Direction	ARQ-M
ASCII	Screen Clear	BAUDOT	PACKET

NOR/REV POS/NEG	Filter Tune	Start Stop	Memory Select
Shift Up	VFT Group	ATC	ARQ Channel
Shift Down	Shift	Input Select	Auto Tune
Alphabet	Demod. Mode	AGC	FAX

Figure 2. The M-7000 front panel, and the function charts for its two keyboards.

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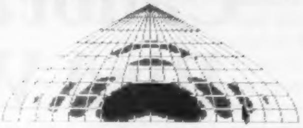

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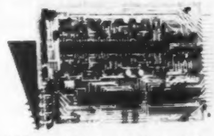

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Number 16 on your Feedback card

Calibration and Repair for Bird Wattmeter Elements

Follow these simple, easy steps—and save big money!

by Francis Kelson HL9BK/K2KSY

Some time ago, I received some burned out and well-used Bird and Sierra wattmeter elements.

As I looked over the elements, I wondered if it was possible to gain access to the passive and active elements inside for replacement or restoration. At 55 bucks per, I figured it was worth my time and effort to check it out, since I had well over a thousand dollars worth laying on the bench in front of me. My investigations paid off handsomely.

The front data plates of most elements are simply glued to the face. Take a sharp-edged instrument, insert it beneath the edge of the plate, and peel it back. Some units have the data plates mounted on with rivets—it's quite simple to drill or buff off the heads to remove the plate. Be sure to keep the data plates since you can reuse them. If the plate is destroyed upon removal, you can replace it with an adhesive metallic tape. When cut to the proper diameter, the tape makes an excellent cover and shield.

A Peek Within

Removing the plate exposes the head of a screw that holds the front brass housing to the unit. You'll notice just below this screw a small hole with just the right diameter to permit the entrance of an alignment tool. If the meter's error is linear (that is, always off by the same amount), a simple tweak of the element's variable resistor, located within, brings the meter within specifications. If there is no variable resistor, remove the mounting screw in the center. This should let the brass housing drop out. There you will find a fixed resistor, which you should replace with a Helitrim 7138 mini variable for future calibration.

Diode Fixes

If the meter's element does not work over the specified frequency range, or if it gives no measurement indication at all, its diode may be defective. As with all wattmeters, the diode is usually the culprit in a failed element. It functions to rectify the incoming signal and to provide something of a DC level. The signal is then filtered as usual by a capacitor, which is followed by one or two load resistors.

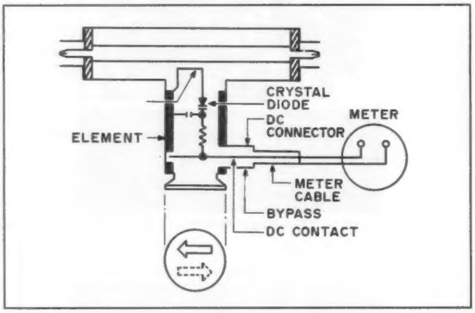

Figure 1. Basic element circuit.

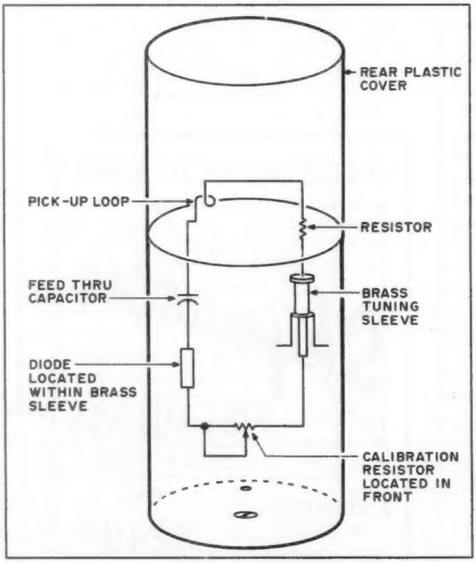

Figure 2. Circuit for the AN/URM-120 element.

To get to the diode, first remove the brass housing in front of the unit, described before. Observe the variable or fixed resistor, and also notice the two recessed screws. Remove them. Then grasp the front housing with one hand and with the other, rotate the plastic cap on the rear. Then exert an outward pressure to force the cap to pop off; this too can be easily replaced.

With the plastic cap removed, notice the two screws in the rear. Desolder the resistor in the front housing. Remove the two screws in the rear and all the components can easily be removed through the rear of the unit.

Check the diode for its proper front-to-back ratio. If it's incorrect, replace it with a suitable diode with the desired frequency response. Remember that diodes and resistors are frequency responsive. If they've been overheated or burned, their main characteristics have changed.

With the rear plastic cap removed, the first item seen is the diode and load resistor. In some cases, as with the 2 through 30 MHz elements, notice the small ferrite block with several turns of #18 enamel wire wrapped around it. This will also be in shunt with a 6Ω resistor. The resistor needs to be desoldered to check the continuity of the coil, which is around 7Ω. This is used to establish the low frequency response along with a feed-through capacitor, which is normally trouble free. Refer to Figure 1 for the concept details.

Something Old, Something New

Some of the older folk should recognize the element shown in Figure 2—the AN/URM-120. It goes all the way back to WWII and is still in use today. Plug those monsters in through the top of the meter housing and rotate the whole slug for forward or reverse.

One of the major wattmeter companies miniaturized the old 120 and created a slug the size of the Bird elements. This one is called the CU2214/U and works considerably better than its older, larger grandfather.

In Figure 2, notice the brass sliding sleeve located on the right side. This is used for frequency response. Within the brass shield, adjust the enclosed diode, the feedthrough capacitor, and the pick-up loop exactly like the CU 753, 754, 755 slugs that went into the AN/URM-120. The CU2214/U slugs are accessed in the same manner as the Bird elements.

Bird and Sierra wattmeters are known and respected throughout the amateur fraternity and engineering fields. The wattmeters are ruggedly constructed and better able to withstand the rigors of military and amateur service—much better than their digital cousins, more so in higher density RF fields. Although the initial money outlay for wattmeter and elements is high, you can now dramatically reduce further expenses on elements with the tech ingenuity hams are famous for! ■

Number 17 on your Feedback card

AERIAL VIEW

Antenna News

Arliss Thompson W7XU
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Predicting Reliable VHF/UHF Coverage

Those of you familiar with the bands above 50 MHz know that, under the proper conditions, some interesting long distance communications are possible at those frequencies. An F2 opening to Europe on 6 meters or a long distance tropo opening on 1296 MHz should excite even the non-VHFer, but unfortunately such openings are not as frequent as we would like. A typical comment on this subject from a ham whose primary interest is HF communications might be something like this: "Sure, the band openings are fun, but I want to work stations more than once a month. Who wants to sit around and listen to receiver hiss all day? Except for rare occasions, you can't work anyone much beyond line-of-sight at those frequencies. Give me 80 meters and you can have everything higher than 30 MHz."

In an effort to counter some of the misconceptions expressed by hams such as the one above, D. W. Bray K2LMG, published an article in the November 1961 issue of *QST* entitled "A Method for Determining VHF Station Capabilities." Bray's work, which later appeared in *The Radio Amateur's VHF Handbook* and in the latest edition of *The ARRL Antenna Handbook*, showed hams how to estimate the capabilities of their stations and how to determine what sort of coverage they could expect on a day-to-day basis at VHF and above. To do this, the reader had to determine station gain through the use of a number of nomograms, then refer to another nomogram to estimate path loss. If station gain exceeded the path loss, then it should be possible to communicate over the given distance on a daily basis (99 percent reliability, assuming smooth earth between the stations). In brief, his work was a graphical demonstration of the fact that relatively minor changes in station capabilities can yield big improvements in reliable coverage, and that in fact VHF/UHF frequencies are good for much better than line-of-sight communications on a day-to-day basis between well-equipped stations. However, although the concept was interesting, it was rather tedious going through the calculations and working your way through the graphs, especially if you wanted to test a number of possible station configurations.

This month's column is devoted to an effort to model K2LMG's work on a computer. Use of the computer greatly simplifies the analysis and allows proposed changes in the station setup to be evaluated in moments with minimal effort.

How the Program Works

With this program, the user enters the distance between the transmitting and receiving stations, plus some information about the two stations, then the computer calculates the minimum transmitting antenna gain needed for reliable communications under those circumstances. The need to specify the distance between the stations is obvious: greater transmission distances incur greater losses. It is also necessary to specify the frequency band of operation because losses over a given path increase with frequency. The program asks the user to enter the mode of operation since some modes of operation inherently require greater signal-to-noise ratios than others for effective communication (CW does have its advantages).

Lines 30 through 340 of the program also require the user to enter 7 of the 8 parameters that determine station gain. Those factors are: transmitter power output, transmission feedline loss, transmitting antenna height, receiver sensitivity, receiving feedline loss, receiving antenna gain, and receiving antenna height. The transmission and receiving feedline losses are negative factors that detract from overall station gain while the other items serve to increase it. Later in the program the computer takes this information and converts it into decibels of gain or loss and balances that against the path loss in dB.

Entering the above parameters is pretty straightforward, except possibly for the receiver sensitivity. Transmitter output in Watts should be readily available, and you probably have a good estimate of feedline losses (if not, that information is available in the various handbooks). The program requires that the receiver sensitivity be entered in dBm (decibels below a milliwatt), a figure that may or may not appear in your rig's manual. If the receiver sensitivity is known for a given signal-to-noise ratio, you can calculate receiver sensitivity using the formula:

Receiver sensitivity (dBm) = $\{10 \times \log(E \times E)\} - 107 - S/N$ where E is the receiver sensitivity in microvolts for a given signal-to-noise ratio, S/N, assuming 50Ω impedance. For instance, if your receiver has a sensitivity of 0.1 microvolts for a 10 dB signal-to-noise ratio, the sensitivity in dBm will be −137. If the only information you have available is your equipment's noise figure you can refer to Bray's nomogram to determine effective receiver sensitivity. (Note that the nomogram gives receiver sensitivity in dBw, not dBm. Since the program uses dBm, use of the nomogram will require the conversion dBm = dBw − 30. Also, that nomogram includes receiving line loss, so if it used to determine receiver sensitivity you will need to enter "0" when the program asks for receiving feedline loss).

Once the above data is entered into the program, the computer does the work. In lines 400–520, the antenna height gain is calculated. At lines 600–610 and at 820,

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```
10 CLS
20 PRINT "A program for estimating transmitting antenna gain for
         VHF/UHF operation.":PRINT:PRINT
300PRINT "Enter frequency band (use upper case letters A,B,C,D,E,F)
400PRINT "                          A - 50 MHz
50 PRINT "                          B - 144
60 PRINT "                          C - 222
70 PRINT "                          D - 432
80 PRINT "                          E - 902
90 PRINT "                          F - 1296
100 INPUT F$
110 PRINT "Enter mode of operation (A,B,C)
120 PRINT "                          A - CW"
130 PRINT "                          B - SSB"
150 PRINT "                          C - AM"
160 INPUT M$
170 PRINT "Enter distance in miles (>10) between transmitting and
          receiving stations."
180 INPUT D
190 PRINT "Enter transmitting station data:"
200 PRINT "       Power output (watts)"
210 INPUT TP
220 PRINT "       Feedline loss (dB)"
230 INPUT TFL
240 PRINT "       Antenna height (feet)"
250 INPUT TAH:PRINT:PRINT
260 PRINT "Enter receiving station data:"
270 RRINT "       Receiver sensitivity (a negative number
              expressing sensitivity"
275 PRINT "       in dB below 1 milliwatt (dBm))"
280 INPUT RS:RS=-RS
285 RS=RS+30
290 PRINT "       Feedline loss (dB)"
300 INPUT RFL
310 PRINT "       Antenna gain (dBd)"
320 INPUT RAG
330 PRINT "       Antenna height (feet)"
340 INPUT RAH
400 'Calculate antenna height gain'
410 IF TAH<=30 THEN THG=20|asteris|LOG(TAH/30)/2.302585
420 IF TAH<=30 THEN GOTO 470
430 IF 20<D THEN THG=14.95|asteris|LOG(TAH/30)/2.302585
440 IF 55<D THEN THG=13.29|asteris|LOG(TAH/30)/2.302585
450 IF 65<D THEN THG=11.63|asteris|LOG(TAH/30)/2.302585
460 IF 80<D THEN THG=9.97|asteris|LOG(TAH/30)/2.302585
470 IF RAH<=30 THEN RHG=20|asteris|LOG(RAH/30)/2.302585
480 IF RAH<=30 THEN GOTO 600
490 IF 20<D THEN RHG=14.95|asteris|LOG(RAH/30)/2.302585
500 IF 55<D THEN RHG=13.29|asteris|LOG(RAH/30)/2.302585
510 IF 65<D THEN R"G=11.63|asteris|LOG(RAH/30)/2.302585
520 IF 80<D THEN RHG=9.97|asteris|LOG(RAH/30)/2.302585
600 'Add 4 dB ground reflection gain, receiving antenna'
610 RAG=RAG+4
700 'Calculate effective receiver sensitivity (ERS)'
710 ERS=RS-RFL+RAG+RHG
800 'Calculate effective transmitting gain (ETG), including 4 dB
     transmitting antenna ground reflection gain'
810 TPDB=10|asteris|LOG(TP)/2.302585
820 ETG=TPDB-TFL+THG+4
900 'Calculate path loss (PL) at 50/144 MHz'
910 PL=1.078|asteris|D+127.59
920 IF D>38.5 THEN PL=.523|asteris|D+148.97
930 IF D>72.6 THEN PL=.295|asteris|D+165.52
940 IF D>104 THEN PL=.077|asteris|D+188.28
950 IF D>125 THEN PL=197.93
960 IF D.223.5 THEN PL=.179|asteris|D+157.93
970 IF D>411 THEN PL=.127|asteris|D+179.31
1000 'Adjust PL for increasing frequency'
1010 IF F$="C" THEN PL=PL+3.76
1020 IF F$="D" THEN PL=PL+9.54
1030 IF F$="E" THEN PL=PL+15.94
1040 IF F$="F" THEN PL=PL+19.08 ELSE PL=PL
1100 'Allowance for loss due to fading'
1110 IF D<100 THEN PL=PL+(D/100)|asteris|7 ELSE PL=PL+7
1200 'Allowance for signal-to-noise ratios required for different modes'
1210 IF M$="B" THEN PL=PL+3
1220 IF M$="C" THEN PL=PL+7 ELSE PL=PL
1300 'Calculate needed transmitting antenna gain'
1310 TAG=PL-ERS-ETG
1400 'Print results'
1410 CLS
1420 IF F$="A" THEN FR$="50"
1430 IF F$="B" THEN FR$="144"
1440 IF F$="C" THEN FR$="222"
1450 IF F$="D" THEN FR$="432"
1460 IF F$="E" THEN FR$="902"
1470 IF F$="F" THEN FR$="1296"
1480 IF M$="A" THEN MM$="CW"
1490 IF M$="B" THEN MM$="SSB"
1500 IF M$="C" THEN MM$="AM"
1510 PRINT "(A) ";FR$;"MHz","(B) Mode:";MM$
1520 PRINT "(C) Distance between stations",D,"miles"
1530 PRINT "(D) Transmitter output power",TP,"watts"
1540 PRINT "(E) Transmission feedline loss",TFL,"dB"
1550 PRINT "(F) Transmitting antenna height",TAH,"feet"
1560 PRINT "(G) Receiver sensitivity    ",-RS+30,"dBm"
1570 PRINT "(H) Receiving feedline loss ",RFL,"dB"
1580 PRINT "(I) Receiving antenna gain  ",RAG-4,"dB"
1590 PRINT "(J) Receiving antenna height",RAH,"feet"
1600 PRINT:PRINT
1610 PRINT "Calculated minimum transmitting antenna gain (dBd) needed"
1620 PRINT "   to overcome path loss (assuming need to maintain high"
1630 PRINT "   reliability) is:":PRINT:PRINT
1640 PRINT TAG,"db":PRINT:PRINT
1650 PRINT "Enter 'X' to exit or 'A,B,C,D,E,F,G,H,I,J' to change
          any of the values above.
1660 INPUT R$
1670 IF R$="X" THEN END ELSE PRINT "enter new value"
1680 IF R$="A" THEN PRINT "(A)50 (B)144 (C)222 (D)432 (E) 902
                          (F)1296":INPUT F$:GOTO 900
1690 IF R$="B" THEN PRINT "(A)CU (B)SSB (C)AM":INPUT M$:GOTO 900
1700 IF R$="C" THEN INPUT D:TAG=TAG-4:RAG=RAG-4:GOTO 400
1710 IF R$="D" THEN INPUT TP:GOTO 800
1720 IF R$="E" THEN INPUT TFL:GOTO 800
1730 IF R$="F" THEN INPUT TAH:TAG=TAG-4:RAG=RAG-4:GOTO 400
1740 IF R$="G" THEN INPUT RS:RS=-RS+30:GOTO 700
1750 IF R$="H" THEN INPUT RFL:GOTO 700
1760 IF R$="I" THEN INPUT RAG:GOTO 600
1770 IF R$="J" THEN INPUT RAH:TAG=TAC-4:RAG=RAG-4:GOTO 470
```

Program that determines reliable VHF/UHF coverage. It uses seven user-entered parameters that determine station gain. This programs was written in GW-BASIC, but should be easily modifiable to run in other forms of BASIC.

4 dB of additional gain is added in, due to ground reflection gain for the transmitting and receiving antennas. The effective receiver sensitivity is calculated in lines 700–710 and, as noted in the program, the effective transmitting gain is determined in lines 800–820.

Program lines 900–970 calculate the path loss at VHF for the distance between the transmitting and receiving stations. Note that the relationship between path loss over real earth and distance is not a linear one. Bray's article contains some graphs that demonstrate this clearly, and show why relatively minor changes in your station may lead to a notable increase in effective range.

The path loss calculated above is adjusted for increased losses at higher frequencies in lines 1000–1040. Further on, allowances are made for fading (plus or −17 dB from the average level at 100 miles) and required signal-to-noise ratios for modes other than CW.

Finally, in lines 1300–1310, the needed transmitting antenna gain is calculated. If a negative number appears here in the printout, it simply means that station gain could be reduced to the degree indicated while still maintaining contact. Lines 1400–1640 print to the screen the initial conditions specified and the calculated transmitting antenna gain needed for those conditions. Subsequent portions of the program allow a change to be made in any of the initially specified parameters and a new gain figure is then calculated. An example:

Frequency: 144 MHz
Mode: SSB
Distance: 100 miles
Power out: 10 W
Transmitter feedline loss: 2 dB
Transmitting antenna height: 30 feet
Receiver sensitivity: −142 dBm
Receiving feedline loss: 2 dB
Receiving antenna gain: 10 dB
Receiving antenna height: 50 feet
Needed transmitting antenna gain: approximately 6.8 dB

Other Thoughts

This program was written on a Tandy 1000SX in GW-BASIC. If you have an IBM-compatible computer, you should be able to enter the program as is and have it work. If your computer uses a different version on BASIC, you may need to make some modifications in the listing. In the past, I have received requests to rewrite a program so that it would run on a Commodore or some other manufacturer's computer. Unfortunately, I do not have access to those machines and cannot supply such listings. I may be able to point out one potential source of difficulty in translating the program, however, and that deals with the calculation of logarithms. Although the program listing has lines containing statements such as "LOG (X)," the computer actually calculates the natural (base e) log, not the base 10 log that is implied. That is why the correction factor of 2.302585 appears in lines using the LOG function. If your computer calculates base 10 logarithms with the LOG command you will need to remove the above noted correction factor to get proper results. It's an easily made correction, but it's an example of what changes may be necessary when translating between different versions of BASIC. (If your computer executes the command "PRINT LOG(100)" and comes back with "2", you know it is already doing base 10 logs).

I am interested in reader-suggested improvements to this program. One likely area for improvement concerns the modeling of the path loss curves that appeared in the original article. While this version of the program gives reasonable linear approximations of the path loss curves, they are just that, approximations. Perhaps some reader has better data and skills in this regard.

Other Business

Fred Sontag N0CAO/KA2XAE sent along some interesting information regarding the February 1989 "Aerial View" column on simple 17m antennas. It seems that Fred has an experimental license to operate on 17 meters and states that he and other members of his experimental group are getting good results with easily built antennas, including dipoles, vee-beams, a modified Butternut ground-mounted vertical, and a G5RV antenna. The experimental group (Bill Orr W6SAI/KM2XDW, California; Stu Cowan W2LX/KM2XDU, New Hampshire; Bob Stankus WS4I/KB2XCQ, Virginia; Phil Galasso K2PG/KA2XUK, New Jersey; and Fred N0CAO/KA2XAE, Missouri) hold schedules regularly on Saturdays and Sundays at 1600 and 1900 UTC on 18.111 MHz. While you won't be able to join them on the air until this summer (when the band is scheduled for release to US hams), they welcome signal reports from listeners. ■

Continued from page 26

wooden dowel for rigidity, drill the vertical and horizontal spreader holes with an offset up to ½". Then you can use one solid metal spreader support for adding stability. The ½" offset will not make any significant changes in the antenna's performance.

How to Build a Basic Quad

1. If you want only the 2 meter antenna, omit all 220 references.
2. Study all diagrams and illustrations before continuing. Cut and drill all the hardware.

NOTE: If you're building a dual-band version, be sure to connect the appropriate radios to the coax ends during tune up.

3. Before tuning, install all aluminum spreader supports, the metal mast, and hardware that you are going to use. (This allows you to compensate for any reflection.) Make the Bazooka Balun, and firmly tape down the coax and balun to the spreader, boom, and mast.
4. Tune up the antenna with as little surrounding metal as possible, and with the quad pointing away from any near structures. Construct the reflector and driver of both bands by dimensions. Do not solder; *tape* the coax baluns into place.
5. Tune-up procedure. For dual-band only: tune up the 220 band antenna first, then the 2 meter band. Because of interaction between the band elements, you will have to refine your tuning on both drivers.

For tune-up, use 146.000 MHz and 223.000 MHz. Adjust the driver feedpoints. By increasing or decreasing reflector wire length, you can obtain the lowest SWR reading at the selected frequency. HINT: Adjust the drive's best SWR and trim up with reflector, then go back to the driver and retrim, etc. You can usually expect the following results:

Reflector and Driver Only SWR

144.100	1.7:1	223.500	1:1
145.000	1.4:1	223.000	1:1
145.500	1:1	222.500	1:1
148.000	1:1	222.000	1.3:1

6. Permanently install and solder the directors to the specified dimensions. SWR will probably go up, which will require going back to step four and tuning/trimming up again to obtain the best SWR.

Typical Results

144.100	2.3:1	224.000	1.2:1
145.000	1.4:1	223.500	1:1
145.500	1:1	223.000	1:1
147.500	1:1	222.500	1:1
148.000	1.2:1	222.000	1.4:1

7. When SWR is as low as you can get it, solder and fasten down the reflector. Recheck the SWR and trim with the driver. Then solder the driver but *don't fasten it down.*
8. Measure all spreader elements to insure a proper diamond shape. Straighten and align spreaders so they line up.
9. If you have a field strength meter or a distant visual repeater, adjust the front lobe for directivity. First, move the horizontal driver spreaders left or right to obtain maximum indication on the field strength or S-meter reading. When sighting down the vertical spreaders, the antenna of the meter or repeater is hidden by the spreaders. This alignment is critical for the accuracy of the beam bearing.
10. You now have a finished antenna! Preserve the antenna in any fashion you deem necessary for your environment. I recommend caulking the coax on the driver feed connections with silicon, brushing marine spar varnish over a coat of paint, and pegging the spreader wooden dowels.

See you on the hunt! ■

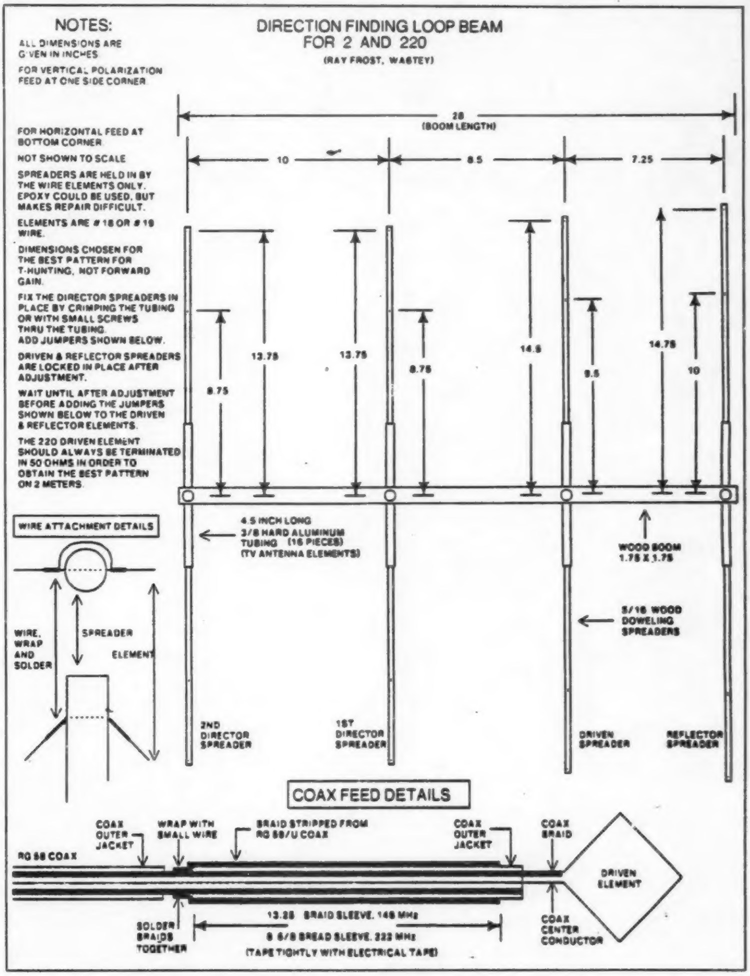
NOTES:
ALL DIMENSIONS ARE GIVEN IN INCHES
FOR VERTICAL POLARIZATION FEED AT ONE SIDE CORNER
FOR HORIZONTAL FEED AT BOTTOM CORNER
NOT SHOWN TO SCALE
SPREADERS ARE HELD IN BY THE WIRE ELEMENTS ONLY. EPOXY COULD BE USED, BUT MAKES REPAIR DIFFICULT.
ELEMENTS ARE # 18 OR # 19 WIRE.
DIMENSIONS CHOSEN FOR THE BEST PATTERN FOR T-HUNTING, NOT FORWARD GAIN.
FIX THE DIRECTOR SPREADERS IN PLACE BY CRIMPING THE TUBING OR WITH SMALL SCREWS THRU THE TUBING. ADD JUMPERS SHOWN BELOW.
DRIVEN & REFLECTOR SPREADERS ARE LOCKED IN PLACE AFTER ADJUSTMENT.
WAIT UNTIL AFTER ADJUSTMENT BEFORE ADDING THE JUMPERS SHOWN BELOW TO THE DRIVEN & REFLECTOR ELEMENTS.
THE 220 DRIVEN ELEMENT SHOULD ALWAYS BE TERMINATED IN 50 OHMS IN ORDER TO OBTAIN THE BEST PATTERN ON 2 METERS.
DIRECTION FINDING LOOP BEAM
FOR 2 AND 220
(RAY FROST, WA6TEY)
28
(BOOM LENGTH)
10
8.5
7.25
13.75
8.75
13.75
8.75
14.5
9.5
14.75
10
4.5 INCH LONG 3/8 HARD ALUMINUM TUBING (16 PIECES) (TV ANTENNA ELEMENTS)
WOOD BOOM 1.75 X 1.75
5/16 WOOD DOWELING SPREADERS
WIRE ATTACHMENT DETAILS
WIRE, WRAP AND SOLDER
SPREADER
ELEMENT
2ND DIRECTOR SPREADER
1ST DIRECTOR SPREADER
DRIVEN SPREADER
REFLECTOR SPREADER
COAX FEED DETAILS
RG 58 COAX
COAX OUTER JACKET
WRAP WITH SMALL WIRE
BRAID STRIPPED FROM RG 58/U COAX
COAX OUTER JACKET
COAX BRAID
DRIVEN ELEMENT
SOLDER BRAIDS TOGETHER
13.25 BRAID SLEEVE, 146 MHz
8 5/8 BREAD SLEEVE, 222 MHz
(TAPE TIGHTLY WITH ELECTRICAL TAPE)
COAX CENTER CONDUCTOR

Figure 1. Direction Finding Loop Beam for 2m and 220.

BASE DIMENSIONS FOR QUADS

Elements	Y	Z*4	Element Spacing	Bazooka
2 meters, 146.000 MHz				
reflector	14.75	86.4	7.25	13.25
driver	14.5	82.0	8.5	
directors	13.75	77.6	10	
1-¼ meters, 223.000 MHz				
reflector	10	57.0	7.25	8.66
driver	9.5	53.5	8.5	
directors	8.75	50.0	10	

*All dimensions are in tenths of inches.

Number 19 on your Feedback card

Stay With the State Of The Art

Cheap way to stay on the cutting edge.

by Peter Doherty W1UO

Electronics is a fast-moving industry. Did you ever wonder about how you might keep up with all the new products flooding the market every month, before they become old news? If you are an advanced hobbyist, then you are probably itching to experiment with the newest products as soon as they hit the market.

Finding out about what's new in electronics may be easier than you think. Armed with no more than a roll of stamps, you can be on top of the latest in the electronics industry.

I can hear you moaning already. With the postage to pay and the kids' college expenses coming up, you can barely afford subscriptions to the ham magazines. Well, if you qualify, you can receive dozens of electronic trade magazines at no cost. These trade magazines cover new products, often before they become readily available to the general public. Manufacturers advertise their new products in hopes that others will implement them into their latest designs. These magazines also contain information on how to use all these new products.

Sources and Resources

One of the best sources of information on components and equipment is *Electronic Component News,* published by Chilton. This glossy, color tabloid lists hundreds of new items each month, dealing with items as small as capacitors and as large as computers. Also included in each issue is a focus article on products at the technological horizon. For instance, the latest issue has an in-depth discussion of CMOS Array Logic. These focus articles contain a wealth of information on the background theory and use of the featured products.

Another useful magazine is *Electronic Products,* published by Hearst Business Communications. It, too, has a wealth of advertising, besides many feature articles. For instance, the latest issue has four articles on power supplies, as well as articles on static RAMs and electroluminescent displays. The "Products Highlights" section contains brief discussions on the latest in product technology, with good descriptions and prices, while the IC Update section contains the latest lists of new integrated circuits rolling out of the foundries.

Electronic Manufacturing, published by Lake Publishing, focuses more on the actual assembly of electronics instead of the individual components used. Recent articles looked at cabinets, enclosures, and EMI/RFI shielding. This magazine also contains a "New Products" section. If you need to know how to build and where to enclose your latest electronic creation, this is the place to look.

When it gets down to the actual design, a good source of information is *Electronic Design,* by Hayden Publishing. With sections devoted to design perspectives, innovations, reports, and applications, it looks at the process of turning ideas into hardware. The applications section is especially handy in this regard. A current article deals with the 80386 CPU chip and its role in desktop CAE tools.

If you're interested in computers, *Computer Design,* by PennWell Publishing, would be to your liking. It deals with computer technology from the chip level to the system level. Recent articles featured Gallium Arsenide ICs and disk drive technology. Again, the advertisements abound with useful information.

As the name implies, *Microwaves & RF* covers the radio spectrum, from low frequency RF to the upper limits. It has news of the latest projects, designs, and product technology. Its design feature section recently contained an excellent article on using spectrum analyzers in IMD measurements. With the increasing interest in the microwave frequencies, and the age-old interest in RF, this magazine presents some of the best information around.

For news, try *Electronic Engineering Times,* by CMP Publications. In newspaper format, it comments on people and companies. It has the friendly feel of a cup of coffee and your morning newspaper. There is always a lively debate in the "Letters" section, and the editorials are stimulating. Given its audience, it is heavy with product advertisements.

No discussion would be complete without mentioning the source of ideas from out of this world—*NASA Tech Briefs,* by Associated Business Publications. It contains great information on the research of ingenious individuals. Many of the products and ideas are not even on the market yet; they're waiting for some entrepreneur to turn them into reality. Not only does this magazine have sections on electronic components, circuits, and systems, but it also covers physical science, materials, computer programs, mechanics, machinery, fabrication, mathematics, and life sciences. A recent issue featured NASA technology applied to solar powered vehicles. For technology and ideas pushing the outer limits, this magazine makes for fascinating reading.

Getting Connected

It's not hard to tap into this wealth of information. If you are a qualified person, all the above publications are FREE. What qualifies you? You or your company must be involved in the field that the magazine focuses on. First, write to the magazine you're interested in, preferably on company letterhead, and ask for a subscription form. If your line of work is not in electronics, but if you're a dedicated experimenter, then it's up to you to convince the publisher of your qualifications. If you don't qualify for a free subscription, you'll be asked to pay for it. When you receive your subscription card, just fill it out and send it back. About every six to twelve months, you'll be asked to renew your subscription by filling out a new card.

The following list is not exhaustive, but it's a good place to start. Be forewarned, as your name will be put on free subscription mailing lists and magazine offers will flood in. With all the new products and ideas to experiment with, the hardest thing will be finding the time to read all this good information!

Electronic Trade Magazines

Electronic Component News
Chilton Company
Chilton Way
PO Box 2010
Radnor PA 19089

Electronic Products
Hearst Business Communications, Inc.
645 Stewart Ave.
Garden City NY 11530

Electronic Manufacturing
Lake Publishing Corp.
PO Box 159
17730 W. Peterson Road
Libertyville IL 60048

Electronic Design/Microwaves & RF
Hayden Publishing Co., Inc.
10 Mulholland Drive
Hasbrouck Heights NJ 07604

Electronic Servicing and Technology
PO Box 12901
Overland Park, KS 66212-9981

Computer Design
PennWell Publishing Company
PO Box 417
119 Russell St.
Littleton MA 01460

Electronic Engineers Times
CMP Publications, Inc.
PO Box 2010
Manhasset NY 11030

NASA Tech Briefs
NASA STI Facility

Manager, TU Division
PO Box 8757
Baltimore MD 21240

EDN
275 Washington St.
Newton, MA 02158

RF Design
6300 S. Syracuse Way
Suite 650
Englewood, CO 80111

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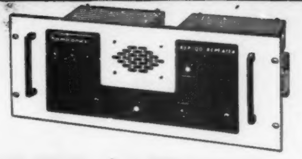
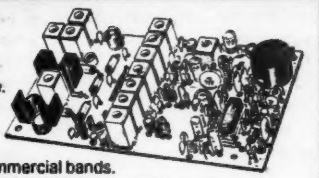
VHF OR UHF



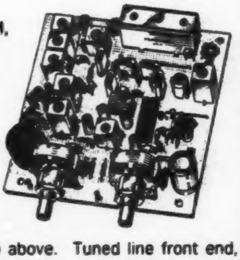
FEATURES:

- **SENSITIVITY SECOND TO NONE! GaAsFET front end** on vhf models gives 12dB SINAD of 0.12uV (vhf), 0.15uV (220). UHF model 0.25uV std, 0.1uV with optional helical resonator preamp.
- **SELECTIVITY THAT CAN'T BE BEAT!** Both 8-pole xtal filter & ceramic filter for **> 100dB at only ± 12kHz.** Helical resonator front end to combat desense & intermod.
- **CLEAN, STABLE TRANSMITTER,** up to 18W output standard; 50W with accessory power amplifier.
- **FCC TYPE ACCEPTED** for commercial high band and uhf.
- **Courtesy beep,** field-programmable CWID, flutter-proof squelch, automatic frequency control to compensate for off-frequency transmitters (all standard features).
- **Full range of options** available, such as autopatch, phone line or radio remote control, sub-audible tones, duplexers.

HIGH PERFORMANCE TRANSMITTERS & RECEIVERS FOR REPEATERS AUDIO & DIGITAL LINKS, TELEMETRY, ETC.



- **FM EXCITERS:** Kits $99, W/t $179. 2W continuous duty. TCXO & xtal oven options available.
- **TA51 for 10M, 6M, 2M, 150-174, 220 MHz.**
- **TA451 for uhf.** FCC type accepted for commercial bands.
- Call for latest information on 900 MHz transmitters.
- **VHF & UHF AMPLIFIERS.** For FM, SSB, ATV. Output from 10 to 50 Watts. Several models, kits starting at $79.

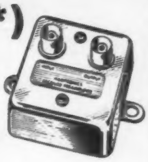


- **R144/R220 FM RECEIVERS** for 2M, 150-174, or 220 MHz. **GaAs FET** front end, 0.12uV sensitivity! Both crystal & ceramic filters plus helical resonator front end for exceptional selectivity: > 100dB at ± 12kHz (best available anywhere)! Flutter-proof squelch. AFC tracks drifting transmitters. Kit $149, w/t $229.
- **R451 UHF FM RCVR.** Similar to above. Tuned line front end, 0.25uV sens. (0.1uV with optional hel. res. preamp). Kit $149, w/t $229.
- **R901 FM RCVR FOR 900 MHZ.** Triple-conversion, GaAs FET front end, 0.2uV sens. Kit $169, w/t $259.
- **R76 ECONOMY VHF FM RCVR** for 10M, 6M, 2M, 220. Without hel res or afc. Kits only $129.
- **Weather satellite & AM Aircraft receivers also avail.**

FCC TYPE-ACCEPTED TRANSMITTERS & RECEIVERS AVAILABLE FOR HIGH-BAND AND UHF. CALL FOR DETAILS.

GaAs FET PREAMPS
at a fraction of the cost of comparable units!

LNG -(*)
GaAs FET PREAMP



ONLY $59!
Wired/tested

FEATURES:

- **Very Low Noise:** 0.7dB VHF, 0.8dB UHF
- **High Gain:** 13-20dB, depending on frequency
- **Wide Dynamic Range:** to resist overload
- **Stable:** new-type dual-gate GaAs FET

** Specify tuning range desired: 26-30, 46-56, 137-150, 150-172, 210-230, 400-470, or 800-960 MHz.*

LNW -(*)
MINIATURE GaAs FET PREAMP

ONLY $24/kit,
$39 Wired/tested

GaAs FET Preamp similar to LNG, except designed for **low cost & small size.** Only 5/8"W x 1-5/8"L x 3/4"H. Easily mounts in many radios.

** Specify tuning range desired: 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, or 400-500 MHz.*

LNS-(*)
IN-LINE PREAMP

ONLY $79/kit,
$99 Wired/tested

GaAs FET Preamp with features similar to LNG series, except **automatically switches out of line during transmit.** Use with base or mobile transceivers up to 25W.

**Specify tuning range desired: 120-175, 200-240, or 400-500 MHz.*

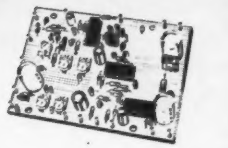
HELICAL RESONATOR PREAMPS

Low-noise preamps with helical resonators **reduce intermod & cross-band** interference in critical applications.

MODEL HRA-(*), $49 vhf, $84 uhf.

** Specify tuning range desired: 142-150, 150-162, 162-174, 213-233, 410-454, or 454-475.*

ACCESSORIES



COR-3 REPEATER CONTROLLER kit. Features adjustable tail & time-out timers, solid-state relay, courtesy beep, and local speaker amplifier. $49

CWID kit. Diode programmed, adjustable tone, speed, and timer, to go with COR-3. .... $59

NEW **COR-4** kit. Complete COR and CWID all on one board for easy construction. CMOS logic for low power consumption. Many new features. EPROM programmed; specify call letters.. $99

NEW **TD-3 SUBAUDIBLE TONE DECODER/ENCODER** kit. ... $24

TD-2 DTMF DECODER/CONTROLLER kit. Full 16 digits, with toll-call restrictor, programmable. Can turn 5 functions on/off. Great for selective calling, too! $79

AP-3 AUTOPATCH kit. Use with above for repeater autopatch. Reverse patch and phone line remote control are std. $79

AP-2 SIMPLEX AUTOPATCH Timing Board kit. Use with above for simplex operation. $39

MO-202 FSK DATA MODULATOR kit. Run up to 1200 baud digital signals through any fm transmitter with full handshakes. Radio link computers, telemetry gear, etc. $39

DE-202 FSK DEMODULATOR kit. For receive end of link. $39

9600 BAUD DIGITAL RF LINKS. Low-cost packet networking system, consisting of new MO-96 Modem and special versions of our 220 or 450 mHz FM Transmitters and Receivers. Interface directly with most TNC's. Fast, diode-switched PA's output 15 or 50W. *Call for info on the right system for your application!*

RECEIVING CONVERTERS

		Antenna Input Range	Receiver Output
		28-32	144-148
		50-52	28-30
		50-54	144-148
VHF		136-138	28-30
MODELS		144-148	28-30
		145-147	28-30
Kit with Case	$59	146-148	28-30
Kit less Case	$39	220-222	28-30
Wired w/case	$89	220-224	50-54
		222-224	28-30
UHF MODELS		432-434	28-30
		435-437	28-30
Kit with Case	$69	432-436	144-148
Kit less Case	$49	432-436	50-54
Wired w/case	$99	439.25	61.25
		902-928	422-448
		903-922	430-450

See catalog for full line of 2w transmitting converters for vhf & uhf. Kits only $79. Linear Amplifiers avail. up to 50 w.

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- **Order by phone or mail • Min $3 S & H per order**
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Number 19 on your Feedback card

Stay With the State Of The Art

Cheap way to stay on the cutting edge.

by Peter Doherty W1UO

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I can hear you moaning already. With the postage to pay and the kids' college expenses coming up, you can barely afford subscriptions to the ham magazines. Well, if you qualify, you can receive dozens of electronic trade magazines at no cost. These trade magazines cover new products, often before they become readily available to the general public. Manufacturers advertise their new products in hopes that others will implement them into their latest designs. These magazines also contain information on how to use all these new products.

Sources and Resources

One of the best sources of information on components and equipment is *Electronic Component News,* published by Chilton. This glossy, color tabloid lists hundreds of new items each month, dealing with items as small as capacitors and as large as computers. Also included in each issue is a focus article on products at the technological horizon. For instance, the latest issue has an in-depth discussion of CMOS Array Logic. These focus articles contain a wealth of information on the background theory and use of the featured products.

Another useful magazine is *Electronic Products,* published by Hearst Business Communications. It, too, has a wealth of advertising, besides many feature articles. For instance, the latest issue has four articles on power supplies, as well as articles on static RAMs and electroluminescent displays. The "Products Highlights" section contains brief discussions on the latest in product technology, with good descriptions and prices, while the IC Update section contains the latest lists of new integrated circuits rolling out of the foundries.

Electronic Manufacturing, published by Lake Publishing, focuses more on the actual assembly of electronics instead of the individual components used. Recent articles looked at cabinets, enclosures, and EMI/RFI shielding. This magazine also contains a "New Products" section. If you need to know how to build and where to enclose your latest electronic creation, this is the place to look.

When it gets down to the actual design, a good source of information is *Electronic Design,* by Hayden Publishing. With sections devoted to design perspectives, innovations, reports, and applications, it looks at the process of turning ideas into hardware. The applications section is especially handy in this regard. A current article deals with the 80386 CPU chip and its role in desktop CAE tools.

If you're interested in computers, *Computer Design*, by PennWell Publishing, would be to your liking. It deals with computer technology from the chip level to the system level. Recent articles featured Gallium Arsenide ICs and disk drive technology. Again, the advertisements abound with useful information.

As the name implies, *Microwaves & RF* covers the radio spectrum, from low frequency RF to the upper limits. It has news of the latest projects, designs, and product technology. Its design feature section recently contained an excellent article on using spectrum analyzers in IMD measurements. With the increasing interest in the microwave frequencies, and the age-old interest in RF, this magazine presents some of the best information around.

For news, try *Electronic Engineering Times,* by CMP Publications. In newspaper format, it comments on people and companies. It has the friendly feel of a cup of coffee and your morning newspaper. There is always a lively debate in the "Letters" section, and the editorials are stimulating. Given its audience, it is heavy with product advertisements.

No discussion would be complete without mentioning the source of ideas from out of this world—*NASA Tech Briefs,* by Associated Business Publications. It contains great information on the research of ingenious individuals. Many of the products and ideas are not even on the market yet; they're waiting for some entrepreneur to turn them into reality. Not only does this magazine have sections on electronic components, circuits, and systems, but it also covers physical science, materials, computer programs, mechanics, machinery, fabrication, mathematics, and life sciences. A recent issue featured NASA technology applied to solar powered vehicles. For technology and ideas pushing the outer limits, this magazine makes for fascinating reading.

Getting Connected

It's not hard to tap into this wealth of information. If you are a qualified person, all the above publications are FREE. What qualifies you? You or your company must be involved in the field that the magazine focuses on. First, write to the magazine you're interested in, preferably on company letterhead, and ask for a subscription form. If your line of work is not in electronics, but if you're a dedicated experimenter, then it's up to you to convince the publisher of your qualifications. If you don't qualify for a free subscription, you'll be asked to pay for it. When you receive your subscription card, just fill it out and send it back. About every six to twelve months, you'll be asked to renew your subscription by filling out a new card.

The following list is not exhaustive, but it's a good place to start. Be forewarned, as your name will be put on free subscription mailing lists and magazine offers will flood in. With all the new products and ideas to experiment with, the hardest thing will be finding the time to read all this good information!

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Electronic Component News
Chilton Company
Chilton Way
PO Box 2010
Radnor PA 19089

Electronic Products
Hearst Business Communications, Inc.
645 Stewart Ave.
Garden City NY 11530

Electronic Manufacturing
Lake Publishing Corp.
PO Box 159
17730 W. Peterson Road
Libertyville IL 60048

Electronic Design/Microwaves & RF
Hayden Publishing Co., Inc.
10 Mulholland Drive
Hasbrouck Heights NJ 07604

Electronic Servicing and Technology
PO Box 12901
Overland Park, KS 66212-9981

Computer Design
PennWell Publishing Company
PO Box 417
119 Russell St.
Littleton MA 01460

Electronic Engineers Times
CMP Publications, Inc.
PO Box 2010
Manhasset NY 11030

NASA Tech Briefs
NASA STI Facility

Manager, TU Division
PO Box 8757
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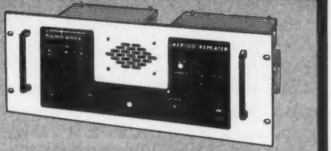

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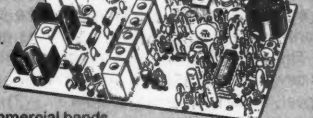

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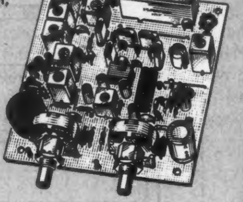

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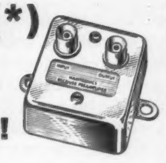

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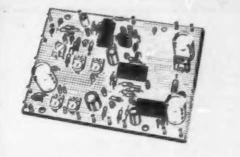

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50-54	144-148
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144-146	28-30
145-147	28-30
146-148	28-30
220-222	28-30
220-224	50-54
222-224	28-30
432-434	28-30
435-437	28-30
432-436	144-148
432-436	50-54
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10 GHz Contest Preparations

For the upcoming 10 GHz ARRL microwave contest, I would like to cover a few items related to system improvements that can increase your contacts and provide ease of operation. Most of the first items are related to the tripod and antenna system, and how to properly aim a dish antenna at a remote station. In another column, we will cover the use of a grid square direction and distance location program that you can run on your computer, using BASIC.

Also, with news of involvement of amateurs in your local area who are putting on nets for VHF/UHF and microwave activity, we will create a common ground and larger sharing of ideas and construction notes. This assistance can be put to great advantage. We'll cover the antenna and what can be done to improve on the base, and work our way to the feed or system transceiver.

Tripod for a Dish Antenna

A tripod that will support a microwave dish antenna should be sturdy, yet still small enough to be carried or packed in a car trunk for transportation. Camera or general purpose photographic tripods are good for a start, but they are not sturdy enough to hold a small dish antenna. In a pinch, heavily weighted, you can make them work. One possible source of surplus tripods in your area is your local television station, college, or vocational school. Also, check your local land surveyors, as any of them might just have a surplus tripod available for relatively little outlay. Kerry Banke N6IZW, one of our local group members, picked up an excellent wooden tripod at a local surveyor's shop for next to nothing. It has adjustable legs, and folds up to a very small unit about 2½ feet long. Check out your local shops to see what you can find. You just might get lucky.

> **"... keep the dish accuracy to within 1/16 of a wavelength (0.07")."**

Once you have acquired your tripod, fix a compass setting circle on top of the mount. The compass dial or setting circle should be from eight to 16 inches in diameter. My tripod uses a setting circle 16 inches wide from the front plate of a radar O-scope. Some people have taken two protractors and placed them back to back to form the setting circle. Whatever you use, mount it in the clear to be able to set your antenna pointing to any compass heading you desire.

Once you have secured your setting circle to the bottom part of the mount, attach a pointer to a part of the mount that will rotate and not be in the way when the mount is turned full circle. Select a spot that will not get in the way when you unlock the mount to lock in a microwave signal. All you need is a short piece of metal or plastic to serve as a pointing indicator. This will be your compass setting pointer, and the dish and pointer are set up to magnetic north first before using.

The rest of this month's column is devoted to Jack N6XQ, and his novel 10 GHz antenna system. Take it away, Jack!

Home-brew Odyssey—10 GHz Antenna System

I came up with a different approach when I couldn't locate a dish antenna or suitable tripod—I built one out of wood! The equipment is relatively simple, and the finished product works very well. The ball got rolling when several Solfan microwave burglar alarm units came my way for free, motivating me to get them in use on the 10 GHz ham band (10000–10500 MHz). A brief literature search found that others did this with minimal hardware and effort. I was soon on the air talking to myself through a second Solfan at home on the workbench. A first QSO attempt with W6OYJ on Mt. Soledad eight miles away failed. A trip to WB6IGP's test bench soon showed why sirens went off in the neighborhood during transmission—several turns with a screwdriver put it right back on frequency. A few days later, I had my first X-band contact with W6OYJ!

Now I was hooked on the excitement of working other hams full duplex with just a few milliwatts. This excitement wore off, however, when it became apparent that the reliable line-of-sight range was about 25 miles with the small Solfan horn. A dish was the obvious answer, but a search through the local surplus markets turned up nothing. Contest time rapidly approached, so I decided to shift my efforts into building a dish.

The RSGB *VHF/UHF Manual* has the most comprehensive discussions on dish design parameters. The first decision to make: how large should the dish be? I had to keep it as small as possible,

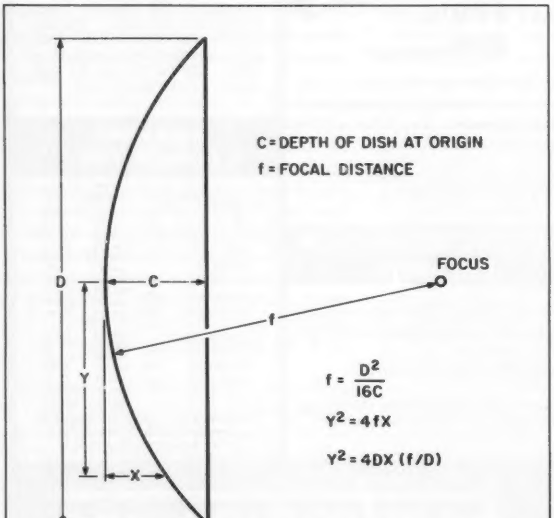

Figure 1. Plan for the paraboloid, showing the relevant dimensions.

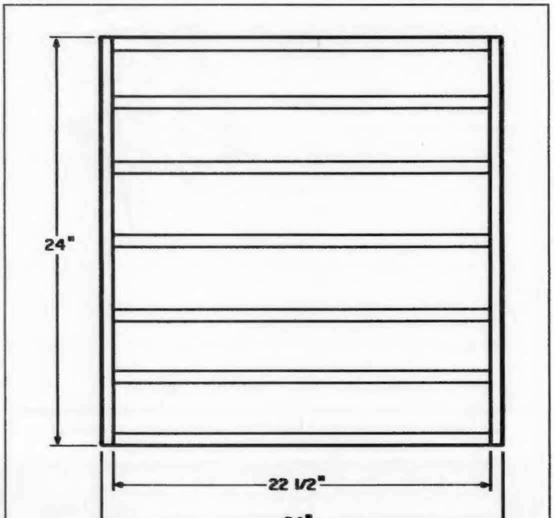

Figure 2. Dish frame layout.

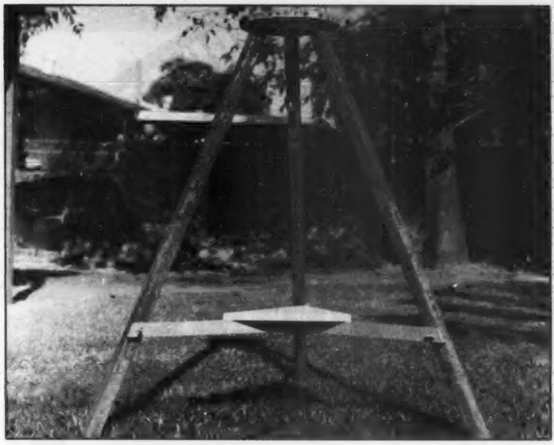

Photo A. Tripod construction with base stabilizer about one foot from the bottom end. Three hinges hold the three legs onto the wood base.

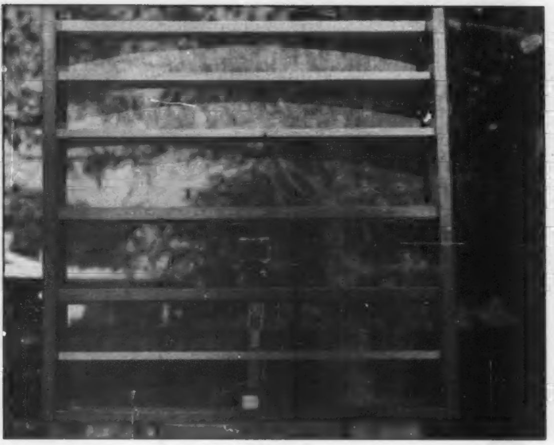

Photo B. N6QO's 10 GHz antenna. Rear view of the dish antenna showing microwave horn antenna feeding the center of the dish. Note the compass degree markings on the base of the unit. The PVC pipe in the center of the mount serves as a bushing.

since most 10 GHz contacts are made from high, unobstructed locations, requiring portable equipment. I decided on a two-foot dish which theoretically has a gain of 35 dBi and a beamwidth of three degrees.

One very important advantage in home-brewing a dish is that you can optimize the dish for your feed antenna. Most hams get all excited about finding a nice dish on the surplus market, only to be confronted with the task of building an optimum feed. Through comparative tests, I estimated the Solfan horn antenna to have a gain of 10–11 dBi. After I constructed the antenna, I discovered the gain is actually around 12 or 13 dBi. This problem was easily cured (discussed later). According to my original estimate, the dish is optimally illuminated with a F/D of 0.8. (See next paragraph for explanation.) This is convenient, as it results in a fairly flat dish which is easy to build. The 24-inch dish will have a focal point of 19.2 inches.

Techies, FYI

See Figure 1, the diagram for the paraboloid. "C" is the depth of the dish. This is the line from the center of the dish to the plane described by the dish rim. "D" is the dish diameter. "F" is the focal distance, which is where the incoming wave energy reflecting off the dish maximally converges. This is the obvious place to mount the feedhorn. The three useful formulas here are: $F = D^2/16C$, $Y^2 = 4FX$, and $Y^2 = 4DX(F/D)$. X and Y are coordinate pairs along the dish curve. Table 1 offers the X/Y pairs for building the dish shown in Figure 2.

Fabricating the Dish

Fashioning a precision parabolic surface is likely the most difficult task for the average amateur. Fiberglass is probably a good material, but it was discounted because it involves making an initial mold, and requires some working experience.

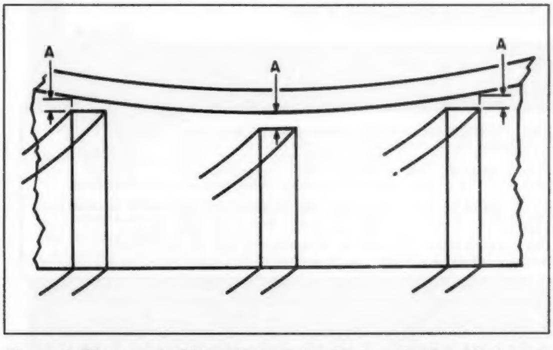

Figure 4. Placement of lateral boards to side boards. For side boards with a thickness of ¾", A = .23".

I had seen articles on wooden dishes with ribs that extend out radially from the center. They usually use round loops of varying diameters for additional strength, and to support the mesh material. What about building a square dish that had support members running in only two orthogonal directions? To my surprise, I discovered that the basic parabolic curve of any structural rib was the same regardless of where it was placed or in which direction it ran. Thus, it was easy to design a square dish and easy to make it with right angle joints. It has an advantage for portable operation, too—the flat bottom is convenient for supporting and rotating the dish at its center of gravity. Figure 2 shows the basic layout of the dish frame.

I recommend using good quality wood to insure lasting accuracy. For the sides and bottom I used some left over 1 x 6-inch door jamb stock that was surfaced on four sides and kiln dried. Equivalent material in the lumber yard costs about 90 cents per foot. You can use 1 x 3s, which cost about 30 cents a foot, for the interior lateral boards. Three-quarter-inch stock is overkill, and the extra milling required to produce half-inch stock is not worth it unless you are considering weight.

Antenna Screen

The mesh used is aluminum insect screening, readily available and inexpensive. The loss with this mesh is negligible, even at K-band. The screening conforms well to the parabolic shape of the relatively flat dish. I applied a coat of enamel over the zinc chromate primer to extend the life of the mesh—important when you live near the ocean!

The theoretical gain of a dish is achieved only when the shape is perfectly paraboloid and optimally fed. A wavelength at 10 GHz is about 1.15 inches. My design goal was to keep the dish accuracy to within 1/16 of a wavelength (0.07 inch). This inaccuracy sacrifices about 1 dB of gain. Gain diminishes rapidly with greater inaccuracy—a 1.9 wavelength (0.128 inch) error results in 6 dB loss! An antenna with this error factor has no more gain than a perfect paraboloid antenna one-half its diame-

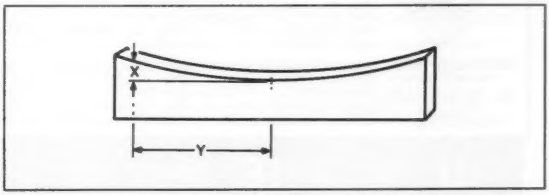

Figure 3. Method for fashioning the template.

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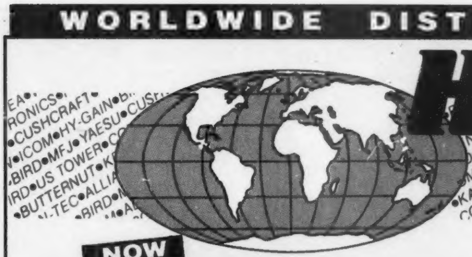

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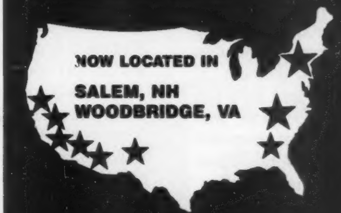

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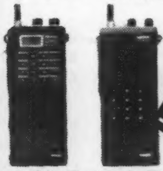

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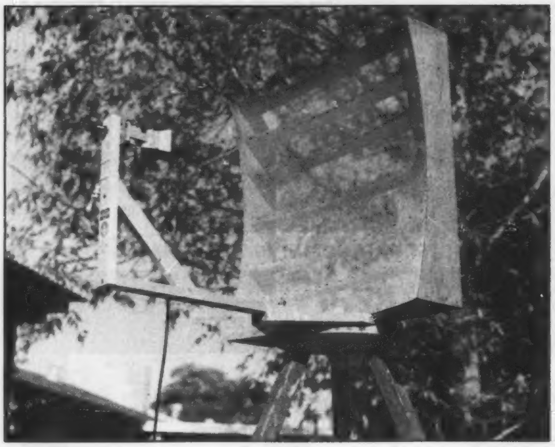

Photo C. Front view of N6XQ's completed dish antenna and Solfan feed system, tripod mounted and ready to use. This system works very well and costs little to build.

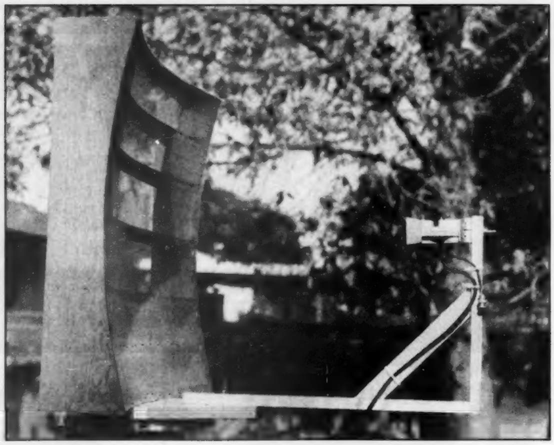

Photo D. Side diagonal view showing the supporting members holding the wire mesh.

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ter. Measure and fabricate as accurately as possible. Take care to not rush during cutting and assembly.

Performance

This antenna has really held its own in the field. I have made contacts of 175 and 208 miles with the 10 milliwatt Solfan transceiver system, shown in the photographs. The 208 mile contact was over a water path with station elevations of 400 and 200 feet, respectively. The horn feed antenna was recently trimmed by ¼ inch to reduce the gain so that it would match the wooden dish better. Dish gain went up ¾ dB.

The bottom of the dish frame and the feed horn support have a single piece of wood stock to allow attachment to the top of the tripod base. After marking the lower wood tripod base with a compass dial, this dish has everything to enable you to point your microwave dish antenna properly.

Each time you place the tripod in operation, properly position the mount with compass setting circle. Take a compass bearing on magnetic north and set up the front of the dish and the compass pointer to agree, with both pointing toward magnetic north. When you want to aim your dish in another direction, just unlock the upper part of the mount, keeping the compass setting circle in place on the lower part of the mount. Then rotate the dish to the new magnetic bearing. By keeping the base of the tripod always pointing direct magnetic north, you don't have to guess about the location of the other station.

Y	X
0	0
1	.013
2	.052
3	.117
4	.208
5	.325
6	.468
7	.638
8	.833
9	1.054
10	1.302
11	1.576
12	1.875
13	2.20
14	2.55
15	2.93
16	3.33
17	3.76

Table 1. X/Y coordinate values for the dish curve, corresponding to an F/D of 0.8. The last five Y values, 13–17, are used only for template to check final alignment.

The Other Station's Magnetic Bearing

Two methods are used to obtain the other station's magnetic bearing from your transmitting location. In the first method, you obtain a large, detailed map of the area. For short-range, line-of-sight contacts, a standard city map works fine, but longer distances may require a US Geodetic Survey map. This pen-and-ink method works well, but it takes time and care to determine location and compass bearings.

In the second method, you run a grid square program on your computer which uses the six-figure grid square identification, which you need for exchanging on 10 GHz contacts. (See grid square ID program article in last month's issue.) This program, assembled by Leon WA5BNH, will give you forward and reverse compass bearings as well as distance measurements in miles and kilometers between selected locations. This is the program we use in our San Diego Microwave Group.

Constructing the 10 GHz Tripod

1. Make the template. Select a straight board 34 inches long, and draw the curve, as shown in Figure 3, according to the figures in Table 1. Carefully cut the curve with a jigsaw. Save the concave piece as a template, and for checking the accuracy of the assembled dish. The convex piece can be cut to 24 inches and used as one of the two side boards.
2. Using the template, cut an additional 24-inch side board and seven 22½-inch lateral boards.
3. Assemble the two side boards to two lateral boards to form a square. Make the assembly on a perfectly flat surface to preserve dish accuracy. I used a combination of finishing nails, wood screws, and glue to make the frame strong.
4. Assemble the remaining lateral boards in accordance with Figures 2 and 4. Placement of the lateral boards is not critical except for complying with dimensions "A" in Figure 4.
5. File or sand the flat edges of the cut boards to conform to the parabolic shape. Use the 24-inch concave template as a guide.
6. For portable systems to be tripod-mounted, drill a hole in the center of the bottom lateral board to fit a ½-inch PVC pipe.
7. Seal and paint the wooden frame for weather exposure. I used three coats of marine spar varnish.
8. Staple the aluminum insect screening to the wooden form. Start with the center lateral board and then with a vertical line down the center. Staple outwards to get the mesh to conform to the parabolic shape, and trim excess mesh.
9. Attach brackets to the back of the frame for a tower mount or to make a wood-bearing assembly using ½-inch PVC pipe to secure the dish and tripod top together as pictured.
10. The feed horn can be mounted as shown. The focal point is 19.2 inches. The exact point should be determined experimentally using a beacon or field strength measurement.

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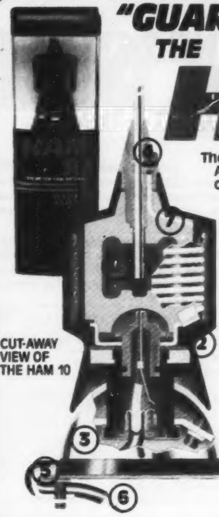

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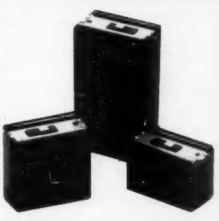

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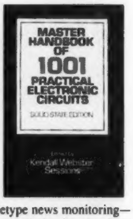

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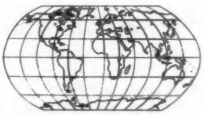

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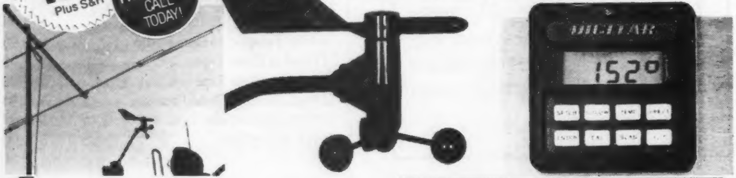

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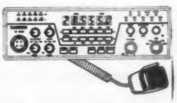

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CIRCLE 292 ON READER SERVICE CARD

73 Review

by Marc Stern N1BLH

MFJ-1278 Multi-Mode Controller

Your inexpensive and easy way to the wonderful world of digital operation!

MFJ Enterprises, Inc.
Box 494
Mississippi State, MS 39762
PH: (800) 647-1800
Price Class: $250

Are you looking for one of the best bargains in data controllers today? You'll very likely find that with the MFJ-1278 Multi-Mode Data Controller. You can have a fully functional multi-mode controller that does everything other controllers do, for a minimum of $50 less.

Easy to Use

The MFJ is also worth a close look because of its simplicity and functionality. The front panel consists of five status LEDs, tuning LEDs, a threshold adjustment, and the power switch. That's about as basic a front as you'll find.

The rear panel is a lot busier. It has connectors for the RS-232 cable, TTL interface (if your PC uses it), speaker inputs for radios one and two, inputs for radio one and a 13.8-volt DC jack, and CW key input and outputs. The printer port is located on the left-hand side of the MFJ-1278, as you face the front panel. Some other data controllers on the market use a serial/parallel signal multiplexing arrangement which requires a custom cable. The 1278 makes life easier by separating the serial and parallel ports, so that you can use easily obtainable standard cables for each. The only disadvantage is unit placement on the console; you must set up the controller so that the printer port is free.

No-effort Updating

On the inside, MFJ uses a quality multi-layer PC board with plated through-holes. The heart of the MFJ-1278 is the nearly universal Z-80 CPU, used in just about every multi-mode controller on the market. Note, though, that there are very few discrete components. Everything is handled by Very Large Scale Integrated (VLSI) circuit technology. All the multi-pin ICs are socketed for easy removal. This makes the MFJ-1278 a snap to update.

For example, it was very easy to update my MFJ-1278 to the latest version of the firmware. All I had to do was remove four sheet metal screws, locate the IC indicated in the update documentation, and remove the IC from its socket. I used a small screwdriver and gently rocked the older firmware out. Then I straightened the pins on the new IC so that it would be easier to insert, and gently inserted it into the socket. After reconfiguring the jumpers to conform to the new firmware version, I closed it up. That was all there was to it; the part that took the longest was reinstalling the screws.

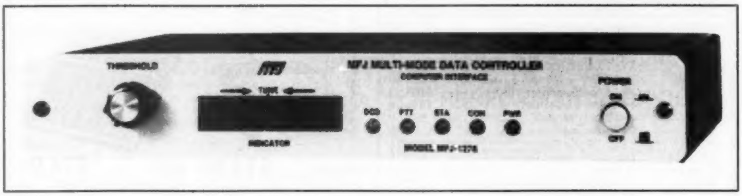

Photo A. The MFJ-1278 Multi-Mode Controller. This unit is an inexpensive way to get involved in a variety of digital modes.

By the way, when you make this type of change, be sure to work in a static-free atmosphere. I use a grounded anti-static mat at my workbench, and I make sure that I am totally static-free before I begin. You can do this with an anti-static mat, bracelet, or strap. Whatever you use, be sure to keep static away from the IC device, otherwise you risk destroying it.

Unit Interfacing

Installing the MFJ-1278 is very easy. Since it uses standard cabling, you can use any RS-232 cable to link it to your personal computer or terminal. The MFJ-1278 is really a computer-in-a-box, and it does all the work. You don't have to have a computer; all you really need is a dumb terminal, and a keyboard for using the controller.

It's also easy to install the parallel port cable. MFJ uses a near-standard IBM-compatible printer port configuration, acknowledging the widespread influence of this giant computer corporation.

After you have installed the RS-232 and the printer cables (be sure the printer cable has a standard Centronics connector on one end, and the DB-25 on the other), hook up your radio or radios to the controller. MFJ supplies two multi-wire cables, terminated with 5-pin DIN connectors, for the controller. The unterminated end is for the radio. You supply the microphone connector.

To interface the radio and controller, all you have to do is follow the wiring diagram, which MFJ includes in your rig's manual, of the microphone cable. In the MFJ manual set, too, there's an appendix that lists the pin-outs of many common late-model rigs. You also have the option of building an interface cable that includes the audio input, or of building a separate cable for the audio input. MFJ offers a separate input jack to handle the audio from radios one and two. This is a multiplexed jack that requires a "stereo" plug. The PK-232 uses separate audio inputs for both radios.

Notice I said "radios." The MFJ multi-mode controller is capable of handling two radios, as opposed to the single radio of older TNCs. You can use your HF radio for HF RTTY, ASCII, AMTOR, Packet, or AMTOR/NAVTEX, and you can use your VHF radio for Packet or CW.

CW Feature

An interesting feature of the MFJ-1278 is its ability to send modulated CW, using audio frequency shift keying (AFSK). This means you can modulate your VHF FM rig for CW use. The controller turns the CW signal on and off at the microphone connector. This also means you can use your VHF radio for such things as over-the-air code practice. Speaking of code practice, you can set up the MFJ-1278 to act as a random code generator for upgrade practice. It automatically generates Farnsworth style CW.

Another nice feature of the MFJ-1278 is its ability to interface a CW key or paddle so that you can send by hand and use the controller as a memory keyer for contesting. Many other controllers let you use them only as your CW interface for the computer/keyboard. MFJ also provides various CW buffers to complement its CW keying feature.

Powering the MFJ-1278

You can roll your own coaxial power connector, using a negative sleeve and positive center, or you can use the wall supply that MFJ supplies. With the cables installed and the MFJ-1278 ready for operation, all that's left is to power it up. The multi-mode controller uses a common start-up configuration of 7 data bits, even parity, and one stop bit. With its autobaud feature, it automatically recognizes the speed that your personal computer or terminal is set up for, and it synchronizes itself after you tap several carriage returns. Using the straight-through cabling and any terminal program, you should see the MFJ-1278 sign on your screen. Then you can set the defaults to your specifications. The defaults include items such as your call, your special AMTOR call (set up with the MYSELCALL command), and various packet parameters.

MFJ supplies a Starter Pack (the MFJ-1282, MFJ-1284, or MFJ-1287, depending on your computer or terminal) with its own terminal program. The Starter Pack allows you to set up windows on your screen as send and receive areas. Another feature of the Starter Pack that I, being a thrifty Yankee, especially like, is its ability to print facsimile pictures to the screen as well as to the computer. It certainly saves a lot of paper to scroll through weather FAX pictures before printing them out. You can save FAX and SSTV pictures and print them later. The Starter Pack software is very friendly, easy to use, and worth buying.

Aside from the Starter Pack, the MFJ-1278 is easy to use in just about every other way. It features full-hardware HDLC, and it now offers a KISS interface so that it is compatible with the emerging TCP/IP protocol. It also is compatible with W0RLI/WA7MBL bulletin board software.

You may change operating parameters two different ways. You can use the SET command to display a menu of choices. After you've entered your selections, tap an X to exit, and you're done. The second way to change parameters consists of bypassing the menus by making a simple, mode change command at the prompt.

"(The MFJ-1278) does everything other controllers do, for a minimum of $50 less."

Interestingly, the unit implements just about everything in software, whereas many other controllers do everything in hardware. Each way has its pros and cons. Doing things via software (setting up Radio 2, for example), switches operation control from panel switches to the keyboard, centralizing control and reducing mechanical wear and tear. On the other hand, multiplexing the audio signal and having to use a "stereo"-style audio jack for separate audio inputs, seems to add to the complexity of things.

MFJ-1278 Performance

In action, the MFJ-1278 ranks with the best. For example, when I was copying AMTOR signals under very rough and noisy conditions, it stayed with the station until it faded totally from the picture as the band shifted. Of course, the number of retries did increase, but that's expected in this situation. Using the MFJ-1278 to receive FAX pictures was lots of fun and easy to do.

Tuning was easy, thanks to the wide, 20-segment tuning LEDs, and the large status LEDs allowed me to easily see what was going on. I tried all the modes and found the MFJ-1278 to be up to any task I asked it to do. It easily handled packet, AMTOR (Mode A, FEC, and Mode B), RTTY, HF ASCII, CW, HF packet, WEFAX, slow scan, and CW very well. It copied RTTY signals faithfully, under changing conditions, as it did AMTOR.

If you think I enjoyed using it, you are right. It was easy and fun to use, especially after I completed the firmware update. The Starter Pack was a good investment. Overall, I found the MFJ-1278 a very worthy device. It is worth considering if you want a good multi-mode controller at a reasonable price. You won't be disappointed! ■

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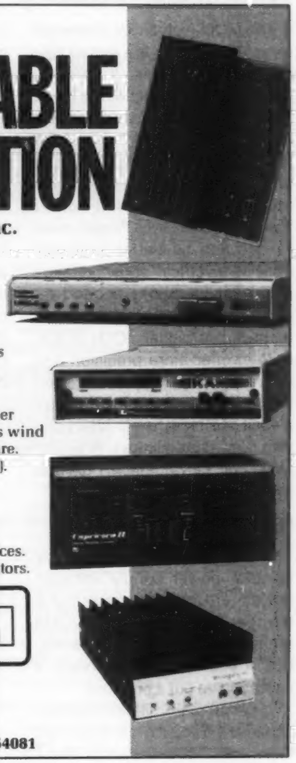

Number 22 on your Feedback card

ASK KABOOM

The Tech Answer Man

Michael Geier KB1UM
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The Versatile VOM

First of all, thanks to Bob K9EUI, who wrote to point out a mistake (gasp!) in my February answer to "Headache #122". Bob said that the zener diodes should be in series, not in parallel. He is, of course, quite right. The diodes should still be connected "back to back"—that is, anode to anode or cathode to cathode; it doesn't matter which. Thanks, Bob.

Last month, when discussing troubleshooting, I referred to the use of an oscilloscope. A scope is the most important piece of test gear you can own, and any ham who can afford it should get one and learn how to use it. Though scopes can be pricey, almost *all* ham budgets can accommodate a VOM. This month's column, therefore, covers troubleshooting methods using only a VOM.

Analog Vs. Digital

The VOM (volt-ohm-milliammeter), or multimeter, is a remarkably versatile instrument. It certainly offers the most bang for the buck, with some models costing less than fifteen dollars! For serious troubleshooting, though, you should get a mid-range model, around the thirty or forty dollar mark, because it will have more ranges and be better protected against electrical abuse. Please note that I refer to a good ol' analog VOM, not a digital instrument. While digital VOMs (a.k.a. DMMs) offer more precision and accuracy, they are not very useful on changing signals. This even includes the more expensive ones with bar graph displays. A swinging meter movement will tell you things that no digital unit can.

Voltage Checks

The meter will tell you quickly whether power supply voltages are there. Don't be concerned if the reading is ½ volt off—VOMs are not meant to be that precise. But, if your 12 volt line reads 4 volts, you've got a problem!

In-circuit DC voltage readings can also tell you a great deal. If all three leads of a transistor show exactly the same reading, the part is probably shorted. If a transistor's base has a bias voltage on it, but the output at the collector or emitter is zero or the same as the supply voltage (and the lead being measured is not connected directly to ground or to the supply), the part is probably open. If a diode has positive voltage at the anode and nothing at the cathode, it is probably open. Note that these are generalizations, and specific circuits can act differently, but they are good guidelines with which to start looking.

Resistance Checks

Resistance measurements are also valuable, but they MUST be performed with the rig's power shut off and the power supply discharged. VOMs are very sensitive to abuse when in the "ohms" mode, and power applied to the leads will very likely ruin your meter.

When checking resistors, be sure to have the meter set for the range required to read the part in question, and always re-zero the meter after changing ranges. As before, don't worry about readings that are close but not exactly on, unless you are working on a high-precision circuit with 1% resistors. If a resistor reads open, then it is. If it reads lower than expected, then the part is probably OK, and other circuit elements are causing the misreading. To be sure, simply unsolder one leg of the resistor and measure it again.

Check diodes by setting the meter on the X10 or X100 scale. The part should read mid-scale in one direction, and open with the leads reversed. As with all in-circuit checks, false readings may occur due to other voltage paths. Just pull one leg and try again.

You can also check transistors. It's best to pull them first. Set the meter on the X100 or X1000 scale. The emitter and collector should read open (or nearly so) in both directions, with the base disconnected. The base and emitter should read like a diode: open one way and mid-scale the other. Tie the base to the collector, and the resulting part should also read like a diode. A bad transistor will typically have an emitter-to-collector short, or read open everywhere.

Don't read FETs and MOSFETs with a VOM, as the parts are very sensitive and easily destroyed. If in-circuit DC measurements indicate a bad part, substitute a new one to be sure.

Capacitors

Here's where an analog VOM really shines. You can check electrolytic capacitors quite easily. Pull one leg of the cap and set the meter to its highest resistance scale. Connect the capacitor's leads together with a clip lead for a few seconds to make sure it is fully discharged. Now, connect the meter across the cap, plus to plus and minus to minus. A small cap, such as 1 microfarad, should give a "blip" on the meter lasting a fraction of a second, then the meter should return to the infinity point. The bigger the cap, the bigger and longer the blip. A 1000 microfarad cap will give quite a swing, and settle slowly back toward infinity. A bad cap will give either no blip at all (if it's open) or swing the meter and not settle back toward infinity (if it's leaky or shorted).

A few words about this test: some meters are wired backward, and must be connected to the cap plus to minus. To check your meter, take an *expendable* known good cap and hook up to it plus to plus. If it reads leaky, discharge it and then try reading it plus to minus. If it now reads correctly, then your meter is indeed backward, and you must connect it plus to minus for all cap tests.

It's best to use a clip lead on one lead of your VOM for all tests, because the resistance between your hands can cause false readings, especially on cap tests.

Happy troubleshooting! Now, let's look at this month's letter.

Dear Kaboom,

I have a Heathkit Microlizer which used to work great with my Yaesu FT-101E. With my new FT-757GXII, though, I get severe white noise and RF feedback. I'm running both the Microlizer's and the radio's mike gains as low as possible but it still seems to be too much. Help, I can't take the noise!

Signed,
Hissed Off

Dear Hissed,

You've got a tremendous impedance mismatch! The Microlizer is a high-impedance device (50–100kΩ) and the '757, like most modern rigs, has a low-impedance (600Ω) input. If you can find one, perhaps in an old microphone, connect a matching transformer between the Microlizer's output and the rig. If you can't get one, try this: place a 47kΩ resistor in series with the output of the Microlizer, and then a 1kΩ resistor from the open end of the 47kΩ resistor to ground. Now connect the junction of the resistors to the mike input of the radio. If there's enough gain to work with, and I suspect there is, then that ought to do it.

Have a tech question? Send it off to "Dear Kaboom" at the above address.

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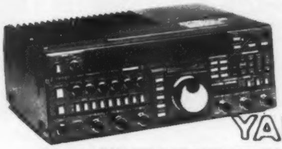

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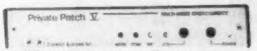

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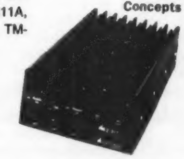

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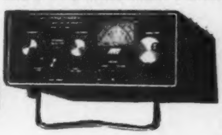

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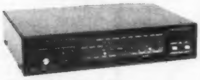

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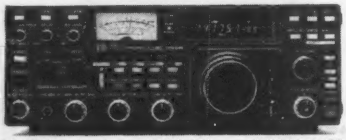

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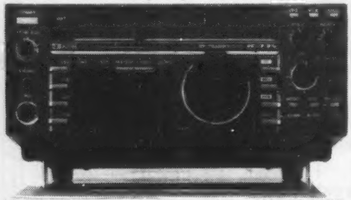

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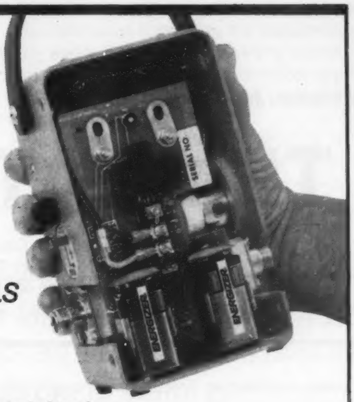
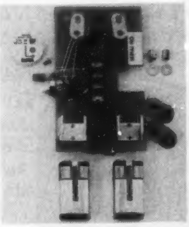


New Mod Kit for Bird Model 43 Wattmeter

MEASURES PEAK POWER OF SSB AND OTHER AM SIGNALS

Bird Model 4300-400 modification kit quickly adapts any Bird Model 43 Wattmeter to measure audio peak power of single sideband and other AM modulated signals.



The 4300-400 kit pc board mounts inside the Model 43 housing, on the meter studs. Estimated conversion time is only 15 minutes from start to finish.

Once modified, you can measure peak power to an 8% F.S. accuracy, without affecting cw operation or accuracy.

And, the Model 4300-400 is surprisingly inexpensive. Contact your Bird distributor or factory for details.

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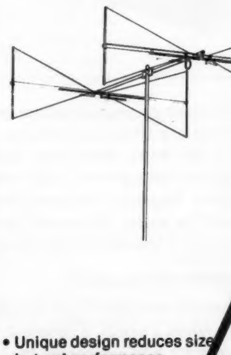

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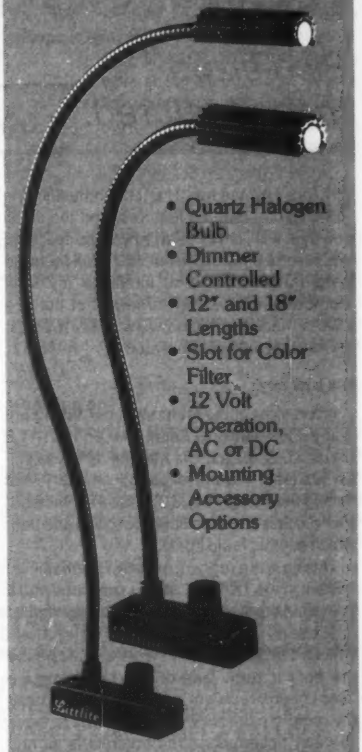

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73 Review by Michael Jay Geier KR1UM

Kenwood TH-25AT

Pico-sized, mega-featured.

Kenwood USA Corp.
2201 E. Dominguez St.
Long Beach CA 90810
Price Class: $350 without CTCSS unit

Once I owned two 2 meter handhelds. The big one had the features, and the small one was, well, small. I vowed I would sell them only if somebody came out with a full-featured programmable unit as small as my little thumbwheel set. With the arrival of the TH-25AT, I made good my vow. I sold the two rigs, and bought the new Kenwood.

It's a Honey

It has most of the features of my old big rig, and yet it's nearly as small as the TH-21AT it replaced. Since today's handhelds have similar features, I won't expound on the joy of having memories, an LCD, and so on. Instead, I will discuss the specifics, both good and bad, which set this radio apart.

This rig has a rugged, solid feel, something I missed in the TH-21AT. It fits in my hand as if it belonged there, and it doesn't go "squish" if I squeeze it. The back is a metal alloy (and heat sink for RF output, as in most new units), and the front is thick plastic. The ad claims the case is water resistant, and in fact, I have used the radio in a drizzle with no ill effects or signs of water penetration. The antenna is fat and substantial-looking, but very flexible.

Power Features

The LCD, mounted on top, is great for checking the frequency when the radio is in my shirt pocket. There's a lock switch to prevent accidental frequency changes, and two green LEDs light up the display at the push of a button. (Finally, no more incandescent bulbs!) The LEDs are surprisingly bright, making the display easy to read in the dark. A second push of the button shuts off the lights, or they will turn off by themselves after about five seconds. The LCD has a bar graph S-meter which also functions as a battery voltage indicator during transmit. This is a very nice touch, and far more useful than the usual RF output indicator.

A 600 mAh NiCd battery comes with the TH-25AT. With average use, it lasts a long time. A range of batteries is available, offering increased operating time or higher RF power output. With the optional AA battery case, an especially nice feature, I can always count on a spare battery.

The automatic battery-saver circuit further extends battery life. When there is no activity or key press for more than 10 seconds, the radio "goes to sleep." Every second, it wakes up for 200 milliseconds to check for a signal. I was bothered at first by the thought that I couldn't turn this feature off, but after using the radio a while, I can see it causes no problems. The most I ever miss is the first letter or two of a callsign. The battery lasts for days when I monitor a relatively quiet repeater.

As if that weren't enough, there's also an automatic power-off circuit which shuts off the rig after 59 minutes of inactivity. It also can't be defeated, and I expected to dislike this feature, too; but in practice it works out fine. The rig beeps to warn me of power down, and any key press will reset the timer.

Frequencies and Memories

In keeping with the overall sturdiness of the radio, the DTMF pad has resilient rubber keys. You can hear the tones while you send them. The pad is only for DTMF. You cannot enter frequencies or otherwise control the rig with it.

The unit receives from 141.000 to 162.995 MHz, which means you can listen to some public service channels, such as NOAA weather. (Yes, you can make it transmit out of band. No, I won't tell you how.) There are 14 memories, four more than most units have. Each memory holds frequency, offset (+, – or simplex), CTCSS frequency and status (with optional CTCSS unit), and even the status of the "reverse" switch! The rig automatically selects standard offsets according to the ARRL band plan, but you can override it, of course. The last two memories can hold odd splits, but you must know the repeater's input and output frequencies, since you can't enter an offset directly.

Frequencies, memories, and CTCSS tones are selected via the top-mounted rotary switch, in conjunction with the MHZ, VFO, MR (memory recall), and CTCSS buttons. In VFO mode, pressing the MHz button causes the rotary switch to step the VFO one MHz per click. Pressing it again returns the VFO to 5 kHz steps. It would have been nice if 100 kHz steps were also available, to avoid the monotonous (not to mention component-wearing) twirling of the rotary switch. Other radios using rotary switches work the same way.

In memory mode, the rotary switch steps back and forth through the memory channels. It's easier to do this with a knob than with buttons on a keypad. One very nice feature is the ability to copy the frequency from any memory to the VFO. Since frequency entry is somewhat inconvenient, this can really save time and effort when you want to set the VFO to a frequency near one already in memory.

KENWOOD
TH-25AT
144MHz
F.LOCK

During CTCSS entry, the rotary switch steps up and down through the CTCSS tones, with each tone's frequency displayed on the LCD. It couldn't be easier. Of course, the optional CTCSS unit is required for this to work.

Scanning and Memory Lockout

Limited memory and band scan functions are provided. When a signal is detected, the scanner pauses for a few seconds, then resumes scanning. There are no other choices. It would be handy to be able to set limits. Some compensation is provided by the radio's ability to scan in either direction. A twist of the rotary switch lets you change scan direction at will, so, if you watch the LCD, you can change direction when the frequency goes out of the ham band, and scan back through it.

Memory lockout is available and easy to do. When scanning memories, for example, I lock out the weather channel to avoid the rig's stopping there each scan; that's what lockout is for. Unfortunately, it is also locked out of manual selection, so that I must unlock it before I can listen to it again! Again, other rotary-controlled rigs work the same way.

TH-25AT on the Road

Walkies, of course, are not intended to be mobile rigs, but many hams use them that way to avoid the cost of yet another radio. Although some full-sized walkies aren't bad for this purpose, the TH-25AT is difficult to operate while driving. Many functions, from memory entry to DTMF dialing, are impossible to do with one hand. Plus, that top-mounted LCD, so great for shirt-pocket use, can't be seen when the radio is lying flat. Oh well, I guess you can't have it all!

Nit-Picks

The TH-25AT is great, but what can't be improved upon? The track into which the battery slides is plastic, unlike the metal ones used by other manufacturers. It allows the battery to wobble a little, and mars the rig's otherwise rock-solid feel. Mine also shows some shedding of the plastic after a few months, which could eventually loosen up the pack enough to lead to intermittent powering of the rig from the pack. Finally, the slight movements of the AA cell pack cause crackles in the receiver, indicating poor contacts. (It doesn't happen with the NiCd pack.)

> ***"The unit receives from 141.000 to 162.995 MHz, which means you can listen to some public service channels, such as NOAA weather."***

Like other small handhelds, the audio amp is puny and so is the speaker. The amp seems to clip at an even lower volume levels than my TH-21AT did. In noisy environments, it can be hard to hear the rig.

Although the transmitter will produce 5 Watts with 13.8 volts applied, there is no DC input jack. You must buy an adapter which slides on in place of the battery.

There is no priority alert function. It was nice with the old rig to be able to monitor two frequencies at once while waiting for a friend to call.

Although sturdy and well protected, the PTT switch is hard to press, and makes my finger hurt after only a short while. Also, there's a fairly strong birdie in the receiver from 156.190–156.200, which will pause the scan. I checked with some friends in other states, and theirs had it, too. It is, however, well out of the ham band, and thus not too important.

If the CTCSS receiving function is on and the received signal is not sending CTCSS, the scan will pause even though the audio will remain squelched. Why? Also, it's impossible to set the transceiver to receive CTCSS without also being set to send it.

The S-meter display has 10 small segments and one big one, suggesting an 11-step display. But the small ones always come on in groups of two, so it's really a six-step display. This is also true of the battery voltage indication, so its resolution is rather limited. Finally, varying S-meter readings cause soft clicks in the receiver, especially on weak signals.

Calling All Manufacturers

Which brings up my final suggestion to all ham radio manufacturers: Put the lithium batteries in holders, so that we ourselves can change them! Why make us send the radios in for repair every five years just to replace a battery?

Conclusion

Even including these minor grievances, this is the best walkie I've ever owned. It feels good and works well, and keeps useless features to a minimum. It does nearly everything I'd want my "dream rig" to do, and it's small enough to take anywhere. I intend to keep it for a long time!

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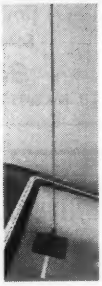

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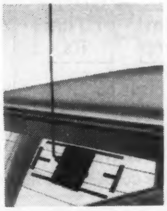

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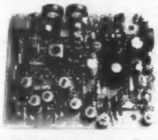

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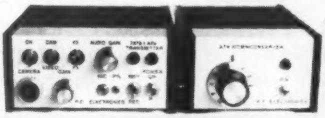

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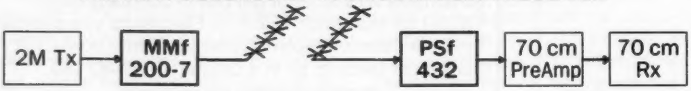

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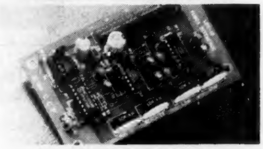

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Selecting Polarization

In previous columns, I explained why your VHF transmitter hunting antenna should have the same polarization as the antenna used by the hider. If your hunting antenna has the wrong polarization, the directly propagated signal will appear to be much weaker. Worse yet, reflected signals from terrain features can appear stronger relative to the direct signal, resulting in false bearings.

Unless hunt rules restrict the hider to a specific polarization, your RDF antenna should be adjustable for horizontal and vertical polarization, and, if possible, for everything in between. Dopplers and some switched-antenna RDF sets can't change polarization, but it's easy with quads and beams.

Antenna Setups

When you set up for T-hunting with an aluminum yagi, make provisions for easy turning of the boom to select polarization. Some long Cushcraft beams have mast-to-boom plates like the one in Photo A. If yours doesn't, make your own with U-bolts and an aluminum plate from a hardware store. U-bolts should be snug, but not so tight that the boom can't be turned by hand. Don't forget the lockwashers.

If you prefer a PVC and fiberglass quad for fox-finding, make a slip joint for changing polarization by using the technique of Photo B. The ½" PVC boom goes through the ¾" x ¾" x ¾" slip tee fitting, which is slotted with a saw cut through the top. Thin rings of PVC material, cemented over the boom on each side of the tee, keep it from sliding. An automotive hose clamp adjusts tightness.

It takes only a few seconds to get out, reach up, and twist the antenna from horizontal to vertical or vice versa. Be sure to dress the feedline with a bit of slack to accommodate the boom rotation. A ½" x ½" x ¾" tee is harder to find, but it eliminates the need for PVC rings. Just split the top with a saw and force the boom through, reaming out the inside of the tee slightly if necessary.

Clarke Harris WB6ADC uses a clever arrangement that allows him to change polarization of his quad by reaching out from inside his van and pulling strings. The strings rotate the boom 90 degrees back and forth, with mechanical stops at horizontal and vertical polarization positions.

Crossed Yagis

Electronic polarization switching is even better than mechanical methods. It's perfect for hunting in bad weather, since you don't have to reach out or get out to twist the antenna boom. Several crossed yagi antennas are available commercially for OSCAR work.

The Cushcraft A144-10T has 10 elements, five for each polarization, with a gamma match on each driven element for direct connection to 50Ω lines. You can mount the antenna with elements horizontal and vertical, and bring a separate coax line for each driven element down to a two-way coaxial switch near the driver's seat.

The following scheme is much more versatile, and has been used successfully in many hunts (and many wins) by Vince Stagnaro WA6DLQ. He adapted it from work done by British VHF DXers, which was described in the *RSGB VHF/UHF Manual*. A six-position rotary switch selects among four linear polarizations and both senses of circular polarization.

WA6DLQ's crossed yagi antenna is home-built from two KLM model 144-148-4 antennas, as shown in Photo C. To make the conversion, remove all elements from one of the KLM antennas and mount them on the boom of the other antenna at exactly right angles to its existing elements. Added elements must be as close as possible on the boom to their cross-polarized counterparts, and original element spacing must be maintained.

The KLM antennas use folded dipole driven elements with 4:1 coax baluns to match 50Ω feed lines. Assemble the two baluns per KLM's instructions and connect them to the driven elements according to the inset in Figure 1b. The inner conductors of the coaxes to the switch box go to the top terminals on the driven elements. Driven element #1 is forward of driven element #2 on the boom.

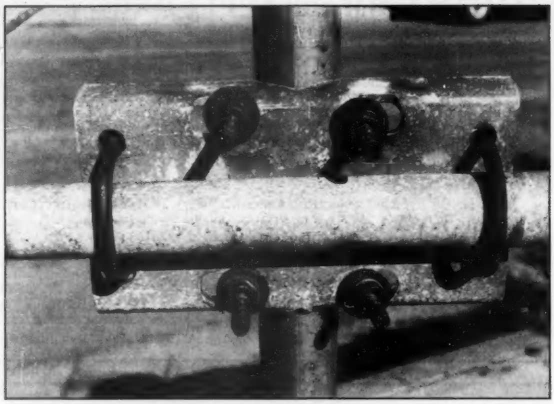


Photo A. An aluminum plate and U-bolts at the boom-to-mast joint allows rotation of the boom to change polarization.

Why place the elements at a 45 degree angle to the boom instead of one set horizontal and one set vertical? Vince did it this way to allow use of a metal mast. If one element set were vertical, it would interact with the metal mast, degrading the directional performance. Moreover, this method keeps the lower tips of the antennas higher above the car roof.

The Switcher Box

The Minibox housing the switch must provide plenty of room for the phasing lines. BNC receptacles are best for the three connectors, but you can also use SO-239 UHF types. Mount them so that their center contacts just touch the wiper arms on the switch decks (see Photo D) and solder them in place.

Select your rotary switch for good RF performance. Check swap meets and surplus sources for switches specially designed for RF use, with 60 degree detents instead of the typical 30 degrees. Because of the critical lengths of the phasing and matching lines, your switch box will work on only one band, just like the cross-polarized yagi. WA6DLQ's setup is for two meters, but you can make a switcher for another band by scaling coax jumper lengths by the inverse ratio of the frequencies.

The quarter-wavelength 75Ω lines are impedance transformers to allow paralleling two 50Ω antennas and feeding the combination with 50Ω line. The quarter- and half-wavelength 50Ω lines provide 90 and 180 degrees phase shift, respectively, for polarization selection.

Small coax such as RG-58 (50Ω) and RG-59 (75Ω) also works for the phasing/matching lines. You can even use smaller coax such as RG-174 (50Ω) and RG-179 (75Ω) between the switch gangs. The lines are so short that loss is not a problem. A foot of RG-174 has only 0.15 dB loss at two meters.

Don't use RG-174 if you have a high power transmitter or amplifi-

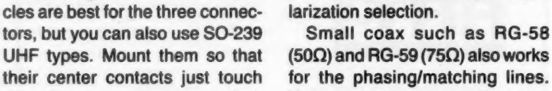


Photo B. Slip joint for PVC quads. The hose clamp adjusts the tightness.

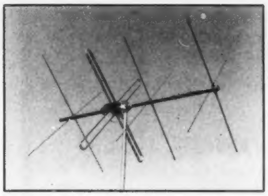
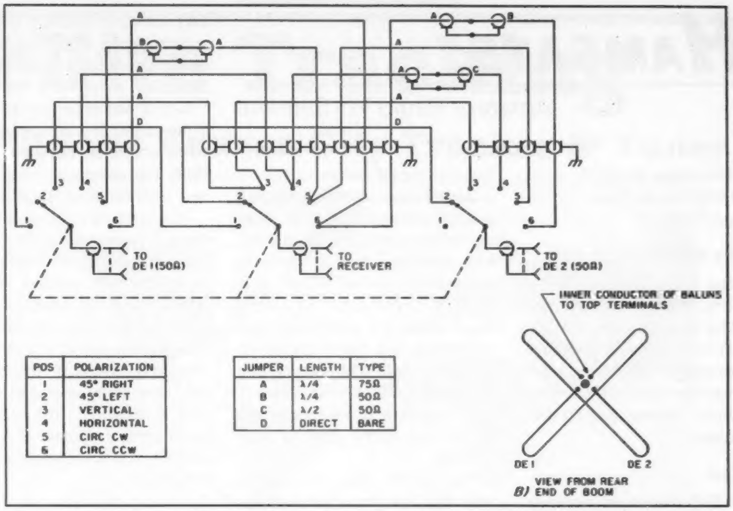


Photo C. The multiple-polarization yagi is made from two KLM beams. Note that element sets are at 45 degree angles to the mast.


A
B
C
D
1
2
3
4
5
6
TO DE 1(50Ω)
TO RECEIVER
TO DE 2 (50Ω)
INNER CONDUCTOR OF BALUNS TO TOP TERMINALS
DE 1
DE 2
B) VIEW FROM REAR END OF BOOM

POS	POLARIZATION
1	45° RIGHT
2	45° LEFT
3	VERTICAL
4	HORIZONTAL
5	CIRC CW
6	CIRC CCW

JUMPER	LENGTH	TYPE
A	λ/4	75Ω
B	λ/4	50Ω
C	λ/2	50Ω
D	DIRECT	BARE

Figure 1. (a) Schematic diagram of the polarization switcher box. (b) The baluns that connect to the driven elements are 4:1.

er—it's rated at only 45 Watts maximum at two meters. Vince used RG-122 (50Ω) and Belden 8280 (75Ω), which are larger than RG-174 but smaller than RG-58. They handle reasonable power and are easy to wire in.

See Figure 1a. The solid-dielectric coax types mentioned above have 69.5% velocity of propagation. Quarter wavelength lines (90 degrees phase shift) are 13¼" and the half-wavelength line (180 degrees phase shift) is 26½" long. Cut eight quarter-wavelength lines from 75Ω coax ("A" jumpers), two quarter-wavelength lines from 50Ω coax ("B" jumpers), and one half-wavelength line from 50Ω coax ("C" jumper).

I don't recommend foam dielectric coax for phasing lines, because its velocity of propagation changes the lengths. A typical factor for foam coax is 75%, but it varies. You can determine the correct value for your coax from tables in handbooks and catalogs, and scale the lengths accordingly, or you can cut the lines to resonance with a dip meter. The two D jumpers are short pieces of bare wire going directly between the appropriate switch terminals.

Strip the braid back ½" and the dielectric back ¼" on each end of the coax jumpers. The center conductor of each line goes to the switch lug, and the braid goes to a ground ring made of copper bus wire surrounding the switch decks, as shown in Photo D.

In three places, a transformer line and a phase shift line must be connected in series between switch decks. Do not use connectors at the junction of the two cables. Remove the jacket ½" from each end and retract the braid. Solder the center conductors together and tape over that junction. Then smooth the braids together over the tape, wrap some fine bare wire over the junction, and solder carefully and quickly. Cover the whole joint with electrical tape or shrink sleeving.

Use low-loss foam coax such as RG-58X for the two lines between the switch box and the antenna-driven elements. The incoming wavefront at the two antennas must arrive at the switch box inputs at exactly the same instant. Therefore, the two lead-ins must be the same length, except to correct for the distance between the driven elements on the boom. For example, if DE1 and DE2 are exactly one inch apart on the boom, make the lead from DE2 exactly ¾" (Remember the velocity factor!) shorter to provide this compensation.

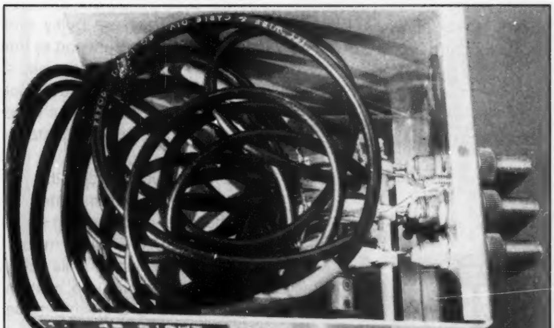


Photo D. Inside view of the switcher box, showing the three-deck ceramic switch with wiper lugs soldered directly to the BNC jacks.

Outguessing the Hider

A multiple polarization antenna system is a big help when hills and buildings cause signal reflections and multipath. At the start of the hunt, check all directions and all polarizations to find the strongest and clearest signal, using your S-meter if the signal is strong enough. If not, use your noise meter if you have one. (If you don't have one, don't despair. There will be one in this column soon.)

In situations when there are nearly equal signal strengths in more than one linear polarization position or in more than one direction, the bearing with least flutter and fewest fluctuations is probably the direct signal.

Some hunters have noticed that horizontally polarized signals have much less polarization shift as they knife-edge over hills and bounce back from them, compared to vertical signals, which readily shift and sometimes appear to go circular. But don't consider this a hard and fast rule.

A linearly polarized signal will appear to be about 3 dB weaker in the circular switch positions. Likewise, a circularly polarized signal will appear to have nearly equal strength in the four linearly polarized switch positions, and will be about 3 dB stronger in the correct circular switch position.

Check polarization frequently through the hunt, particularly as you go over hilltops. What appears to be a 45-degree or circularly polarized signal at the starting point may turn out to be something completely different as you close in. Polarization will be correct only when the signal is exactly "on axis." Signals from the side and rear of the antenna often produce incorrect polarity indications.

Even if your antenna system switcher is built perfectly, your receiver input impedance is probably not exactly 50Ω over the entire band. This mismatch between the antenna system and the receiver can occasionally cause incorrect polarization indications with this switching system. This is not a practical problem in transmitter hunting, but it will cause errors if you try to use the antenna system for serious propagation studies or laboratory-type instrumentation. The mismatch can be masked by switching in 10 dB or so on your attenuator when polarization measurement accuracy is important. (You do have a 50Ω impedance attenuator, don't you?)

One last caution: don't turn the selector switch while transmitting. Good luck, and come back next time for ways to support your antenna mast. Get ready to drill that big hole in the car roof!

Number 25 on your Feedback card

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
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Houston TX 77083

Satellite Activities

During 1989, AMSAT NA is promoting events, contests, and operating activities via AMSAT-OSCAR-13. The satellite is a limited resource, so activities which can overload the transponders and cause battery degradation are avoided.

ZRO Test

The ZRO Technical Achievement Program or "ZRO Test" began on A-O-13 in mid-January after successful reorientation of the satellite. This activity is a test of operating skill and equipment performance. The tests can only be run when the satellite-pointing angle provides uniform signal strengths within the satellite's footprint.

During a typical ZRO Test, a control station sends and repeats numeric code groups at gradually reduced power levels (3 dB each time). Participating operators measure the sensitivity of their systems by monitoring and recording the contents of the transmissions. Those who can copy the satellite's beacon can copy level "zero" of the test. The challenge is to copy the lower power-level transmissions.

All satellite enthusiasts are invited to listen to the A-O-13 ZRO Tests. The downlink frequency on Mode B (70 cm up and 2 meters down) is 145.840 MHz. Mode L (23 cm up and 70 cm down) ZRO Tests will be scheduled later in the year. All transmissions are CW at 10 wpm. Check the AMSAT Nets and Packet bulletins for schedules and updates. Other background information can be found in the November 1988 "Hamsats" column and "Satellite Awards" by WB5RMA in the May 1988 issue of *73*.

Operating Milestones

AMSAT NA has issued certificates to all those who made contacts with specified stations on A-O-13's first day of operation. Other operating events under study include a foxhunt (hidden transmitter hunt) via satellite, and one- or two-hour sprints similar to those on the HF bands.

Dave Guimont WB6LLO prefers events corresponding to milestones in a satellite's life in orbit. The opening day of general transponder use on A-O-13, July 23, 1988, was such an event. Dave began his pursuit of such milestones five years earlier on August 7, 1983 with opening day on AMSAT-OSCAR-10. Table 1 lists contacts Dave has made during noteworthy days in A-O-10's life.

The launch date, first operations day, apogee equator crossings, and maximum northings and southings are among significant events in the life of an amateur satellite. The apogee's sub-latitude position outlines a cyclic path on the surface of the earth as determined by orbital parameters. In the case of A-O-10, the complete cycle takes approximately three years and nine months. WB6LLO has completed a contact at each of these events. A-O-13 takes about 20 years to complete the same cycle. Those who made contacts on A-O-13's "opening day" have begun their own quest for operating milestones via satellite.

The equator crossings and the extremes of latitude Dave pinpointed in Table 1 were determined by 30-second "bracketing" during an applicable five minute period. An IBM PC with an AMSAT satellite tracking program and the latest NASA orbital predictions were used for the computations.

A-O-10 was in service during all of the events. It will hopefully also be in operation during October 1989, the estimated time of the next southernmost apogee.

This effort is not presented as some phenomenal achievement. The same results can be duplicated by the most modest satellite station. It merely indicates one of the many activities that are a part of operating one of the most sophisticated forms of amateur radio. How many operators will be "on frequency" for the next southernmost apogee of A-O-10, or the first northernmost apogee of A-O-13?

Antennas and Antenna Systems

While winter in much of North America has forced hams to put aside antenna projects, this is sometimes the best season for outdoor work in South Texas. Summers can be oppressively humid and hot.

Antenna systems for satellite chasing can be simple and inconspicuous, yet provide excellent results. A recent antenna party at W5EBH provided an opportunity to get some pictures of a system as it was put together.

In the January "Hamsats" column, I noted several antenna systems that active satellite operators prefer. The quad used by Blake W5EBH on 2 meters is not typical, but it was available and provided satisfying contacts. The 70 cm antenna is a KLM 18C with polarization switcher.

Photo A. KA5ODO and N5LKJ position the satellite antennas.

Blake carefully checked the wiring for the Yaesu/Kenpro rotators. It is very easy to invert rotator orientation or mis-wire the system, with two units and control lines involved. Take note of this: Carefully check your system on the ground and label all lines, including the coax.

Since satellite antennas only need a good view of the sky, they don't need much tower. The structure in Photo A is just high enough to allow the antennas to look over the top of Blake's roof. From the street they are not even visible.

A typical HF yagi is a two-dimensional antenna. When put together, it will lie flat on the ground. Satellite antennas designed for circular polarization are three-dimensional. They are bulky and can be difficult to transport to the top of any structure, especially a tower with guy wires. Blake did not have guys, but a hoist was used for safety, and it did make installation easier.

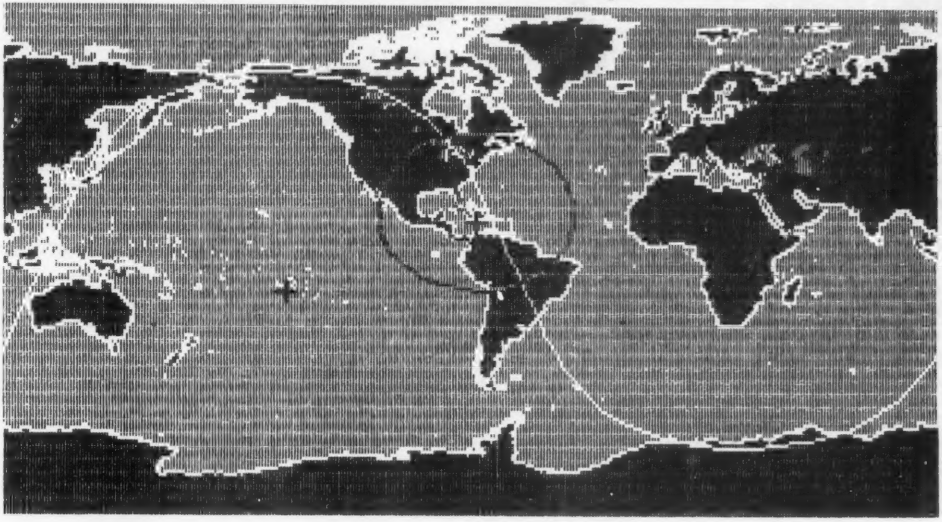
For a satellite system, the azimuth rotator can be mounted inside the tower or supporting structure, but the elevation rotator must be in the clear. In this case, however, the complete system was mounted to a custom-made plate on the top of the tower.

Many satellite enthusiasts use Belden 9913 coax for their antenna installations to keep line losses low. If run around the rotators, make sure to keep a generous

Photo B. KA5ODO secures the tower top plate for the array.

Satellite Tracking

with your PC and the Kansas City Tracker & Tuner



The **Kansas City Tracker** is a hardware and software package that connects between your rotor controller and an IBM XT, AT, or clone. It controls your antenna array, letting your PC track any satellite or orbital body. The **Kansas City Tracker** hardware consists of a half-size interface card that plugs into your PC. It can be connected directly to a Yaesu/Kenpro 5400A/5600A rotor controller. It can be connected to other rotor assemblies using our Rotor Interface Option.

The **Kansas City Tuner** is a companion product that is used in satellite work. It can provide automatic doppler-shift compensation for digital satellite work. The **Tuner** is compatible with most rigs including Yaesu, Kenwood, and Icom. It controls your radio thru its serial computer port (if present) or through the radio's up/down mic-click interface.

The **Kansas City Tracker** and **Tuner** include custom serial interfaces and do not use your computer's valuable COMM ports. The software runs in your PC's "spare time," letting you run other programs at the same time.

The **Kansas City Tracker** and **Tuner** programs are "Terminate-and-Stay-Resident" programs that attach themselves to DOS and disappear. You can run other DOS programs while your antenna tracks its target and your radios are tuned under computer control. This unique feature is especially useful for digital satellite work; a communications program like PROCOMM can be run while the PC aims your antennas and tunes your radios in its spare time. Status pop-up windows allow the user to review and change current and upcoming radio and antenna parameters. The KC Tracker is compatible with DOS 2.00 or higher and will run under DESQ-VIEW.

Satellite and EME Work

The **Kansas City Tracker** and **Kansas City Tuner** are fully compatible with AMSAT's QUIKTRAK (3.2) and with Silicon Solution's GRAFTRAK (2.0). These programs can be used to load the **Kansas City Tracker's** tables with more than 50 satellite passes. We also supply assembled & tested TAPR PSK modems with cases and 110v power supplies.

DX, Contests, and Nets

Working DX or contests and need three hands? Use the **Kansas City Tracker** pop-up to work your antenna rotor for you. The **Kansas City Tracker** is compatible with all DX logging programs. A special callsign aiming program is included for working nets.

Packet BBS

The **Kansas City Tracker** comes complete with special control programs that allow the packet BBS user or control-op to perform automated antenna aiming over an hour, a day, or a week. Your BBS or packet station can be programmed to automatically solicit mail from remote packet sites.

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• KC Tuner Option	$ 79
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loop of this cable around the rotators (see Photo B) to keep rotational stress low. The 9913 cable has a foil shield that does not twist well. Any twisting of the cable near a connector may cause the connector eventually to fail, due to the shield detaching, or the whole cable working loose of the assembly.

After a few hours of work in Blake's back yard, the antennas were up and the cables secured and fished through the attic. Does it work? You bet! Although its appearance is strange, the array is balanced and it performs well on Modes B and J (2 meters up and 70 cm down).

Updates

RS-10/11 continues with Mode A (2 meters up and 10 down) seven days a week. Mode K (15 meters up and 10 down) has been activated simultaneously with Mode A on some weekdays.

Fuji-OSCAR-12 has been activated for very limited operation. Operating schedules can be found on the AMSAT nets and also via the bulletins on UoSAT-OSCAR-11 (1200 baud Bell 202 format). Extended schedules are subject to change, but have been posted on the F-O-12 BBS during Mode JD (digital BBS) operating times.

After a few months of great operation, A-O-10 is back in hibernation. When the solar panels are not properly illuminated, operation via this veteran satellite is suspended. Watch the AMSAT Nets for updates.

A-O-13 continues with exemplary coverage and activity. Proposed operating schedules were presented in last month's column. The ground control stations attempt to adhere to predicted operating itineraries, but minor modifications are common. Mode S operation is the most difficult to predict.

Photo C. WA5ZIB puts a generous loop in the feed/rotator lines from the antennas to the tower.

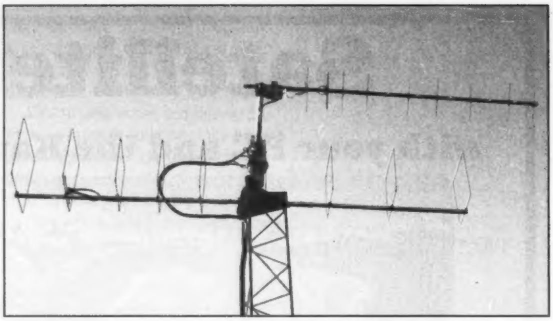

Photo D. The finished satellite antenna installation at W5EBH.

From The Log of WB6LLO

Event	Date	Time	Orbit#*	Station**
Initial contact	7 AUG 1983	0030Z	112	WA5ZIB
1st North most	19 MAY 1984	2000Z	701	KB7RV
1st Equator cross	1 MAR 1985	0850Z	1352	DK2LM
1st South most	28 FEB 1986	1815Z	2043	VE3ER
2nd Equator	27 JAN 1987	0021Z	2727	W2PAV
2nd North most	5 JAN 1988	1006Z	3433	VK7ZBX
3rd Equator	11 DEC 1988	0935Z	4135	VE5XU

*The Orbit adjusted to conform to NASA variations.

** One of the several stations contacted.

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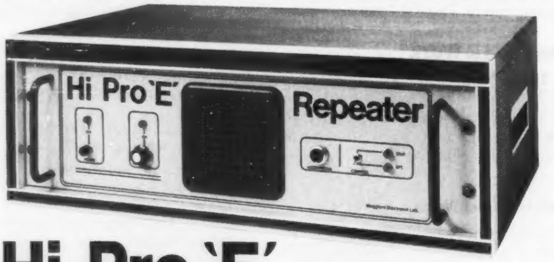

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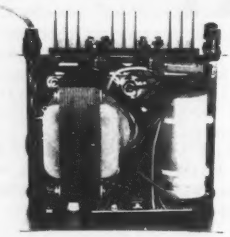

INSIDE VIEW — RS-12A

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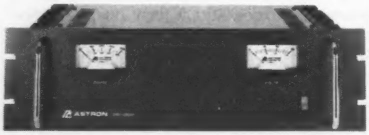

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RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50

RS-A SERIES

MODEL RS-7A

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A	2.5	3	3 × 4¾ × 5¾	4
RS-4A	3	4	3¾ × 6½ × 9	5
RS-5A	4	5	3½ × 6⅛ × 7¼	7
RS-7A	5	7	3¾ × 6½ × 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 × 7½ × 10¾	11
RS-12A	9	12	4½ × 8 × 9	13
RS-12B	9	12	4 × 7½ × 10¾	13
RS-20A	16	20	5 × 9 × 10½	18
RS-35A	25	35	5 × 11 × 11	27
RS-50A	37	50	6 × 13¾ × 11	46

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MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
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RS-50M	37	50	6 × 13¾ × 11	46

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VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	5	7	4 × 7½ × 10¾	10
RS-10S	7.5	10	4 × 7½ × 10¾	12
RS-12S	9	12	4½ × 8 × 9	13
RS-20S	16	20	5 × 9 × 10½	18

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

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Hams Around the World

Tom Gregory N4NW operating TN4NW from Brazzaville, Congo, using WB2DND's computer logging program.

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TN4NW DXpedition to the Congo

"I wanted to put a country on the air that hadn't been on for a long time." So Tom Gregory N4NW began the description of his TN4NW DXpedition to the Congo at DXPO 88 in Washington, DC.

Tom is a member of the US State Department, and has been stationed in Africa for the past several years. During his travels around the Dark Continent, Tom visited about half the countries in Africa, and obtained amateur radio licenses and operated from many of these. But most of these countries were the more common ones; he had been unsuccessful in activating a very rare country. But not through lack of trying!

Chad TT is one of the rarer countries on the amateur bands. Tom had frequently visited that country and talked to the telecommunications officials about obtaining permission to operate. The officials were happy to give him verbal permission, but no one was willing to issue a written license. Since the DXCC desk would not accredit an operation from Chad without written proof of operating permission, Tom had to look elsewhere for his DXpedition to a rare country.

Tom's current assignment is with the embassy in Kinshasa, the capital of Zaire. Directly across the Congo River lies Brazzaville, the capital of the Congo. Zaire was certainly not rare, as it ranked only 99th in *The DX Bulletin*'s 1987 "Most Wanted Countries" survey. Tom alone had made 40,000 contacts from Zaire as 9Q5NW, and there were several other active amateurs in the country. But the Congo was another story.

Amateur operation from the Congo has been scarce since the early 1980s. In fact, the Congo ranked 36th on the "Most Wanted" survey in 1987. The lure of a rare country within sight of his home prompted Tom to seriously pursue an amateur license for TN.

Tom's work took him to Brazzaville on a regular basis, and he used his embassy contacts to begin the long task of obtaining written operating permission. In April 1987, he sent his application for a license to the Congo PTT, which forwarded it to the DSGE, the state security arm of the Congo's government. Through the US embassy, Tom continued to track progress of the application, and was finally able to win an appointment with the Director General of Communications. During the interview, conducted in French with an interpreter, the Director quizzed Tom on his background, military service, his job at the embassy, and more. Apparently satisfied with Tom's responses, he agreed to provide an amateur license, once Tom paid the application fee.

"How much is the fee?" Tom inquired.

The official responded with an outrageous, and obviously arbitrary figure, "200,000 Central African Francs," or over US$300. Tom gulped, excused himself to return to the US embassy for the money, and immediately returned with the cash. The month was February 1988.

In May, Tom had still not received the license. He was concerned over the lack of response. His wife was seriously concerned. Inquiries finally pried the license out of the PTT: TN4NW, valid for six months, and renewable. Tom immediately made plans to operate from Congo.

TN4NW On The Air

There are two ways to cross the Congo River: by the ferry Matadi, with the goats, chickens, and overcrowded conditions; or by private boat, for considerably more money. With more than 600 pounds of radios, computers, antenna, and tower, Tom elected to take the private craft.

On the weekend of June 30, Tom hauled his gear to the home of the secretary of the American Ambassador in Brazzaville, who had offered the use of her house as a base for TN4NW. Tom quickly set up his 40 foot tower and tribander, and plugged his donated ICOM IC-761 into a power conditioner designed to even out the surges and peaks that can destroy sensitive electronic gear. A portable Compaq computer performed all logging functions, running WB2DND's logging software. Tom backed up the computer memory with a hard copy printout in case something happened to the computer hard disk.

The operation was highly successful. That weekend Tom logged 8,056 QSOs with 5,700 different stations, giving thousands of DXers their first shot at the Congo. A subsequent trip in November logged thousands more. Tom made an effort to repeat each callsign, to eliminate ambiguity, and to reduce insurance contacts. However, the many requests for contacts on other bands, such as 40, 80, and 160 meters, were a great time waster. His license was not valid for 160, and the low bands are very noisy in tropical Congo, due to the constant thunderstorms. Despite the occasional abuse by over-anxious DXers, Tom continued with his game plan to give as many DXers as possible a new country.

Unfortunately, this DXpedition was not without considerable monetary cost. For each time across the river, despite the relatively short distance, Tom had to pay $77 in boat fees, and a hotel bill totaling hundreds of dollars. Plus, in compensation for the donation of operating space, Tom felt obliged to take the ambassador's secretary out to dinner, to the tune of about $200. Even a lowly beer costs $11 in Brazzaville!

Having Brazzaville within sight of his home in Zaire has prompted Tom to raise an interesting question. If he set up a remote VHF link from his QTH in Kinshasa to the HF station in Brazzaville, would the TN4NW QSOs so obtained count for DXCC? The station and operator would both be appropriately licensed, and the HF station would be in the Congo. It would be similar to having a very long microphone cord. If a shipboard operator sticks his antenna on the shore, it counts as a land-based station; why should a VHF link be any different? An intriguing question that the DX Advisory Committee may wish to explore soon.

Tom Gregory's Comments

Tom N4NW added some more comments recently: "The logistics of crossing to Brazzaville and remaining there a number of days for operation of TN4NW are almost overwhelming. On top of the cost of travel, and hassles with border officials, there is the daily expense of living in Brazzaville. However, I can overcome the costs, with the support of DXers worldwide, and overcome the hassles with border officials. What I have not been able to overcome is the poor operating practices on the part of a number of hams, particularly those in some of the Southern and Eastern European countries. On top of these poor operating practices comes the addition of American hams who continuously request frequency changes, mode changes, and schedule information. I ask hams, what happened to the practice of listening and working the station when and where he is, and listening to determine what is planned for other times, frequencies, and modes?"

The WB2DND Logging Program

Many DXers working TN4NW were surprised when Tom said that they had already worked on this band. The speed at which he came back with this information obviously precluded any paper duping method. Tom used a logging program especially designed for his needs by Don Greenbaum WB2DND.

Tom wanted a logging program to accomplish the second of his goals. After putting a rare country on the air, he wanted to give a new country to as many DXers as possible, and only secondarily to provide added band or mode QSOs. He also needed a computer logging program that would greatly simplify the task of the QSL manager.

The WB2DND program accomplishes these goals very well. The program includes a master log, containing all contacts made, and provision for "current" logs, very useful for contest work. Once a log is selected from one of the on-screen menus, the DX operator can log online, entering only the callsign, and report, if desired. The program picks up the date and time from the computer system clock and enters band and mode data from the last contact.

If the callsign entered is already in the log, even on a different band or mode, the program flashes this information on the screen. The operator has a choice of deleting the QSO as a dupe, or logging a new band or mode. All this happens with lightning speed on an IBM PC or compatible computer. WB2CHO used the program in the ARRL SS, and many contesters were amazed that by the time they had finished calling, he could come back with: "We've already worked at 1123Z yesterday, you're number 35." Dupe data appears on the screen essentially as fast as you can type.

The WB2DND program also permits the user to edit entries, generate printouts in various forms for contest logs or dupe sheets, backup to the floppy drive to protect valuable log data, and QSL instantly. To QSL a contact, one enters only the callsign; the program then displays all contacts with that station. At the touch of a key, the program prints QSO data labels for that station, which can be affixed to the QSL card. So what if the incoming card has the wrong date, time, mode, or band! The program will locate every contact with that callsign, and print all labels in seconds. A great boon for the over-worked QSL manager!

The WB2DND logging program was designed to meet the needs of Tom Gregory and his QSL manager; it is not an all-purpose program. The data entry is fine for contest-type running, but cumbersome for hunt-and-peck DXing. The operator has to know the names of all logs; they aren't displayed on the screen for easy selection. And editing entries is slow and awkward. The program will locate partial callsigns, but only from the beginning of the call. For example, it will find WA4TDG if you type WA4T, but not if you enter TDG. Also, it is not designed to track multipliers or score in contests. However, DXpeditioners and some contesters may find it very useful. As mentioned above, WB2CHO used it in the ARRL SS with great success. It's easy to keep track of the 76 multipliers in SS on a piece of paper. All files are compatible with dBASE III.

The WB2DND Amateur Radio Log Database is available for $25 from Don Greenbaum WB2DND, 250 Standish Street, Duxbury MA 02332. Specify if you have a hard disk or color monitor. A minimum of 512K of memory (RAM) is required to run it.

Only partly tongue-in-cheek, Tom continues: "A new feature being added to the WB2DND logging program in use at 9Q5NW and TN4NW is the 'lid' function. By using the 'lid' function, the program will flag all logged contacts for that station in the data base. When using the 'lid' function, calls previously flagged have a second flag added, and that call can no longer be added to the log. Indications are displayed on the monitor as to the 'lid' status of the callsign to alert the computer user of the 'lid' status of that station, to remind the DX station not to reward this 'lid' with a QSO. I hope to supply a list of these 'lid' stations to the DX newsletters so other DXpeditions can immediately identify the 'lids.' My QSL manager, AL7EL and I have an agreement: I make the contacts, he takes care of the QSLs. I have no way of determining, without asking the manager, the status of any QSLs. So, if you want to know about your QSL, contact the manager."

Tom continues, "AL7EL is the primary manager for 9Q5NW and TN4NW.

However, as AL7EL's address is not valid in Callbooks prior to 1988, some stations may wish to send their cards for these stations to KC4NC or N4NW (my home call), which is valid after the 1986 Callbook. All QSLs should still be sent to the Callbook address whenever possible.

Also, avoid use of the bureau. The only valid bureau address is N4NW. Cards sent via bureau will be processed by me upon my return to the US, scheduled for October 1989."

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April 28, 29, 30, 1989

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A maximum of 3 spaces per person (non-transferable). Tickets (valid all 3 days) will be sold IN ADVANCE ONLY. No spaces sold at gate. Vendors MUST order registration ticket when ordering flea market spaces.

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Nominations are requested for 'Radio Amateur of the Year,' 'Special Achievement' and 'Technical Achievement' awards. Contact; Hamvention Awards Chairman, Box 964, Dayton, OH 45401.

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• Asst. General Chairman, Ed Hillman, N8ALN

1989 Deadlines
Award Nominations: March 15
Lodging: April 7
License Exams: March 26
Advance Registration and banquet:
USA - April 4 Canada - March 31
Flea Market Space:
Spaces will be allocated by the Hamvention committee from all orders recieved prior to February 1. Express Mail *NOT* be necessary! Notification of space assignment will be mailed by March 15, 1989.

Information
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or, Box 2205, Dayton, OH 45401
Lodging Information: (513) 223-2612
(No Reservations By Phone)

Lodging
Please write to **Lodging, Dayton Hamvention, Chamber Plaza, 5th & Main Streets, Dayton, OH 45402** or refer to our 1988 Hamvention program for lodging information which includes a listing of hotel/motels located in the surrounding areas of Dayton. Reservations for the surrounding area will then become the responsibility of the individual.

HAMVENTION is sponsored by the Dayton Amateur Radio Association Inc.

Advance Registration Form

Dayton Hamvention 1989
Reservation Deadline – USA-April 4, Canada-March 31
Flea Market Reservation Deadline: February 1

Enclose check or money order for amount indicated and send a self addressed stamped envelope.

Please Type or Print your Name and Address clearly.

	How Many		
Admission (valid all 3 days)	______	@ $10.00*	$______
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Women's Luncheon (Saturday)	______	@ $7.00	$______
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Flea Market (Max. 3 spaces)	______	$25/1 space $50/2 adjacent $150/3 adjacent	$______
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NEW PRODUCTS

Compiled by Linda Reneau

PRODUCT OF THE MONTH

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The PacComm TNC-225 packet controller, with Z-80 microprocessor, 32K EPROM, 32K RAM, and full duplex 8530 HDLC controller, is a new design built on the popular features of the TNC-220. Major features include: dual modems to support 1200 baud VHF/UHF and 300 baud HF operation; HF tuning indicator with multicolored bargraph LED display; port for PacComm's 9600 baud FSK modem and satellite modems; personal mailbox at no charge; fifteen front panel status LEDs; and provsion for AMTOR and RTTY modes with upgrade EPROM.

The TNC-225 uses the TCM3105 modem IC for VHF, and the EXAR 2206/2211 ICs and 6-pole active filter for HF operation. Firmware supports TAPR 1.1.6 command set, including KISS and enhancements.

Price, $189.95 fully assembled and tested. Comes with operating manual and cable connectors. Thirty-day return privilege, 1-year warranty. *PacComm Packet Radio Systems, Inc., 3652 W. Cypress St., Tampa FL 33607-4916. Technical information (813) 874-2980. Toll free order: (800) 223-3511 (except Florida). FAX: (813) 872-8696.* Circle Reader Service number 201.

CREATIVE CONTROL PRODUCTS

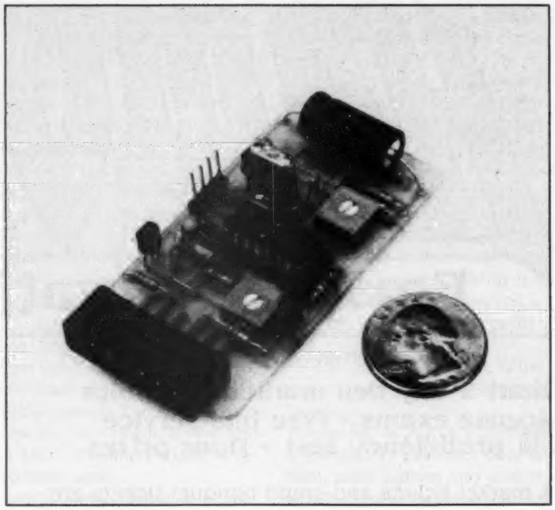
The UAI-20 Universal Audio Interface board, a repeater and link audio mixer from Creative Control Products, features a CTCSS Decode, DTMF Mute, and link Monitor-Mix control.

Audio inputs consist of repeater, link, control receiver, CW/Tone, CTCSS Tone, and auxiliary input. Audio outputs consist of repeater, link, and DTMF. Control inputs consist of repeater COS, CTCSS Mode, DTMF mute, and auxiliary.

The CTCSS Decode logic level is selectable high or low. The UAI-20 has provisions to mute the DTMF tones from the repeater transmit audio via a jumper on the circuit board. Inside of the UAI-20 is an audio filter which removes the sub-audible tone from the repeater receiver audio path. Automatic muting occurs when the selected (by configuring the 6-position DIP switch) CTCSS tone hasn't been decoded.

Full audio is normally present. When the repeater COS is activated, both the repeater and link audio are mixed, resulting in the condition called Monitor-Mix, which is adjustable. When auxiliary control input is activated, link receive audio is muted upon repeater COS activity. Mute and Monitor-Mix are selectable.

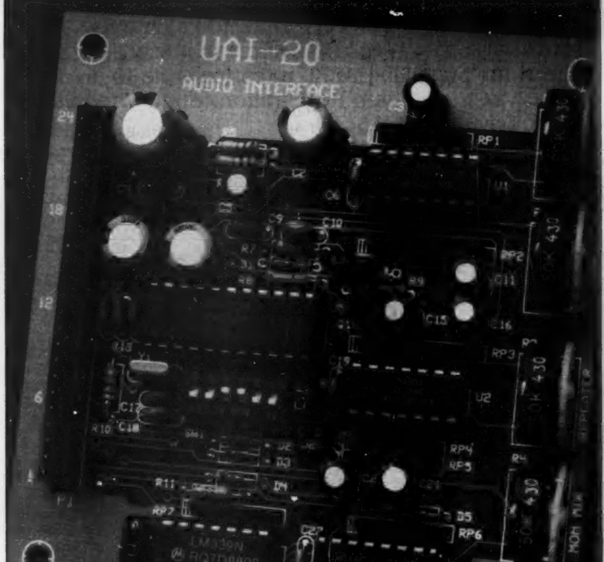
The UAI-20 is for interfacing your repeater receiver, transmitter, and link radio to any standalone repeater controller. Assembled and tested, with manual, the introductory price is $89 plus shipping. *Creative Control Products, 3185 Bunting Avenue, Grand Junction CO 81504. (303) 434-9405.* Circle Reader Service number 205.

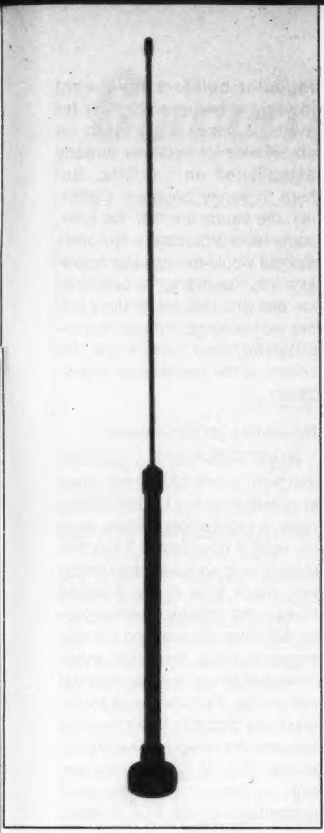


CP INTERFACES

CP Interfaces is producing a very small packet modem measuring 1⅜"x2¾" for the Digicom>64 program. This single-chip, plug-in card uses Texas Instruments' TCM3015JL integrated circuit and a few passive components. Five volts from the cassette port of the Commodore 64/128 run this modem, which consumes about 40 mA. It is small enough to allow other peripheral equipment to remain plugged in during operation.

This new modem permits 1200 baud packet operation on VHF, UHF, and 10 meters with the Digicom>64 software (which emulates the functions of a TNC). Kits are available for $38.50. Assembled and tested boards are $48.50. Shipping and handling costs are $2.50. Contact *CP Interfaces, 922 Baltimore Drive, Orlando FL 32810-5531. 407-629-2965.* Circle Reader Service number 202.





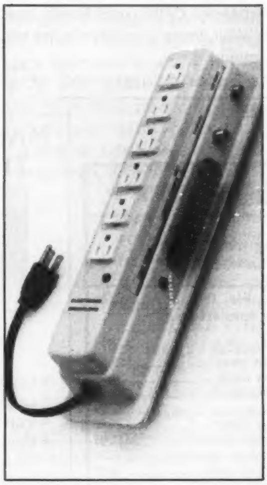
VALOR ENTERPRISES, INC.

Valor Enterprises's PA270 model two plus two dual-band antenna covers it all, from horizon to horizon. This antenna is pretuned, quarter-wave on 2 meters (144–148 MHz VHF) and half-wave on UHF (440–450 MHz). The unit includes silver-plated, spring-loaded contact. It will work on scanner radio UHF/VHF bands. Suggested retail, $49.90. *Valor Enterprises, Inc., 185 West Hamilton Street, West Milton OH 45383. (513) 698–4194. Watts: (800) 543–2197. FAX: (513) 698–7273. Telex: 724–389. Attn: Valor.* Circle Reader Service number 206.

ELECTRONIC SPECIALISTS, INC.

Electronic Specialists is introducing their SATT PRO in-home Satellite Protection System. SATT PRO provides six filter/suppressor protected AC sockets for receiver, VCR, decoder, TVRO control unit, and cable or antenna control box. Spike/Surge protection is provided for eight control and sensor lines to the dish (a 14-line option is available). Signal line Filter Suppressor options include one or two TVRO and 1 or 2 TV VHF/UHF antenna or cable lines.

SATT PRO II-36 offers six AC socket protection, eight-line control cable protection, TVRO cable (F connector), and TV VHF/UHF cable (F connector) protection. From stock, SATT PRO II-36 lists for $240. *Electronic Specialists, Inc., 171 South Main Street, Natick MA 01760. 800-225-4876.* Circle Reader Service number 203.



HAMTRONICS, INC.

Hamtronics, Inc., announces the COR-4 COR/CWID Module, their new, low-power combination unit. It combines all the features of their CWID module COR-3 modules, including courtesy beep, in one 3x7-inch module. This new unit uses CMOS logic and an EPROM for programming, to save assembly time and allow for longer messages. It is ideal for solar/battery powered repeaters, since it draws only 25 mA on idle. Introductory price is $99 for a kit or $159 wired and tested.

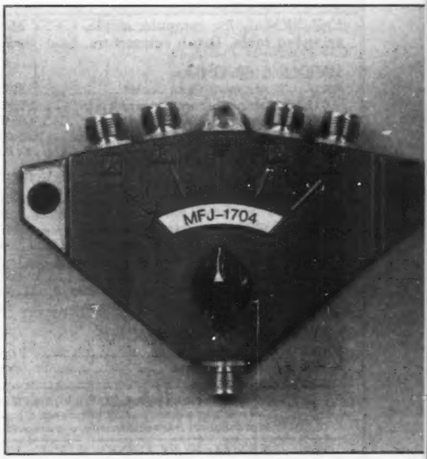
Also from Hamtronics is the TD-3 Subaudible Tone Decoder/Encoder Module, 1⅜"x2 3/16", which can be used with any subaudible tone on Hamtronics, and other, receivers. It has features normally used for repeater service, such as remote on/off capability when used with the TD2 Touch-tone Module. Price, $24 kit, $69 wired and tested. *Hamtronics, Inc., 65-F Moul Road, Hilton NY 14468-9535. (716) 392–9430.* Circle Reader Service number 204.

ADVANCED COMPUTER CONTROLS, INC.

Advanced Computer Controls announces their new FC-900 Interface, which is supported by several ACC repeater controllers. It permits use of the ICOM IC-900 transceiver band units as remote base and link transceivers. The ICOM fiber optic controller and interfaces aren't needed, just the band units. Hookup is simple; everything just plugs together. The FC-900 supports six bands from 29 MHz to 1300 MHz. It has full remote frequency control through Touch-Tone commands. Remote bases and links allow the repeater system designer to extend the range of the repeater and benefit from the elevation of the repeater site for all bands.

The price for the FC-900 Interface is $225. An optional programmable CTCSS encoder is $25. *Advanced Computer Controls, Inc., 2356 Walsh Avenue, Santa Clara CA 95051. (408) 727-3330.*

MFJ ENTERPRISES INC.



The MFJ 1704 4-position, 50-ohm coax antenna switch with lightening protection (replaceable cartridge) handles 2.5 kW PEP, 1 kW CW with low SWR. Isolation is rated from better than 60 dB at 30 MHz to better than 50 dB at 500 MHz. Insertion loss is negligible.

Other features of the MFJ 1704 coax switch are cavity construction, metal strip leads, outside heavy steel cavity case, and mounting holes. Unused positions are automatically grounded, or you can select the convenient center ground position.

Price, $59.95. *MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762. (601) 323–5869. FAX: (601) 323–6551. Telex: 53-4590 MFJ STKV. (800) 647–1800.* Circle Reader Service number 207.

LOOKING WEST

Issues in Ham Radio

Bill Pasternak WA6ITF
28197 Robin Ave.
Saugus CA 91350

[This month's guest writer is Burt Hicks WB6MQV, the Editor/Publisher of *Westlink Report*
. . .de WA6ITF]

Thoughtful Policy

The FCC sanctioned the League's approach to frequency coordination, but so far it has failed to come up with a solution for multiple coordinators. In a letter dated November 28 from Private Radio Bureau Chief Ralph Haller to the ARRL's legal counsel, Christopher Imlay N3AKD, the Commission applauded the ARRL for providing a forum in its Repeater Coordination Newsletter for an exchange of ideas on the subject, for its listing of coordinators, and for its offer to arrange binding arbitration to settle coordinator disputes.

However, a copy of the letter, mailed to *Westlink Report* in an unmarked envelope, demonstrated Haller's lack of understanding of the causes of disputes such as the one in southern California. Haller referred to the infamous Kowalski letter which "created the impression that multiple coordinators for a given frequency band in a given geographical area was a possibility."

Imlay had requested the FCC to support the ARRL's interpretation of the Order in Docket 85-22 which stated that only a single coordinator could exist in a certain band and area jurisdiction, and that where there is divided allegiance, "there can be no coordinator." While agreeing with the ARRL that "there is, in effect, no coordinator," Haller chose not to expand on the interpretation of Section 97.3 (aa). This Section defines what coordinators are, but it does not provide a means for selecting them or limiting them to one in a given domain.

Perhaps the most interesting admission in the letter is Haller's tacit acceptance of Kowalski's error: "Although we did not anticipate that any amateur community would choose multiple coordinators with overlapping responsibilities in a given geographical area, it was apparent from material submitted to us by the two organizations that such had occurred. We concluded that it was not within our province to disturb the choice of the amateur community that the coordinators serve."

A Failure of Understanding

Ralph Haller evidently still fails to understand the implications of having no fixed policy in selecting coordinators. In Southern California, the long-established coordinators (SCRRBA, TASMA, and 220-SMA) were leaders nationwide in the effort to minimize co-channel and adjacent channel interference. When the spectrum began to fill up nearly a decade ago in this area (not "as the bands become saturated," as written by Haller in his letter), these coordinators found ways to make antenna patterns more directional to reduce the conflict of competing repeater stations, coordinate PL tones for a tolerable level of co-channel QRM, and finally say, "Wait, there's no room at the moment."

Experimenters and other repeater builders then went looking elsewhere (higher) for available space. This led to an abundance of systems already established on 1.2 GHz. But here in sunny Southern California, the bands are full. Yet here, some have organized a few other slothful would-be repeater operators into "selecting" a coordinator, one who charges no dues and has no meetings, bylaws, or constitution, and challenge the control of the established organization.

No Justice for the Majority

Ralph Haller says in his letter that with "some 12,000 repeaters in operation in the United States, there is but a single dispute as to the rightful coordinator." But that dispute is in an area inhabited by just about 10% of the licensed hams in the country, where mountaintop relay sites extend the coverage of these machines many times that of the average repeater nationwide. Fortunately, a settlement has probably been reached between the two organizations after the filing of a $5 million lawsuit—an amount which is a good percentage of the FCC's entire annual budget ■

. . .de WB6MQV

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UG21DS N plug for RG8,213,214 Silver	3.35
UG83B N jack to PL259 adapter, teflon	6.50
UG146A SO239 to N plug adapter, teflon	6.50
UG255 SO239 to BNC plug adapter, Amphenol	3.29
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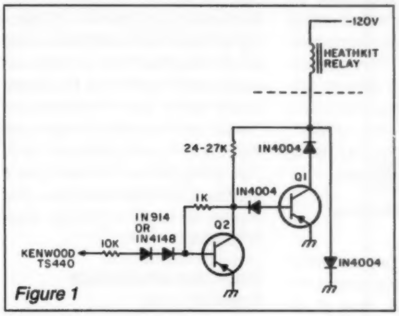

Figure 1

RELAY INTERFACE SOLUTION

Recently, someone asked me how to key the relay of a Heathkit low-band linear from a Kenwood TS-440. The relay power in the linear is obtained from the −120 volt bias supply, and the transmit keying output from the Kenwood is +12 volt at 10 mA maximum. I tried several relay interface solutions with varying results. The attached circuit solved the problem.

The key ingredient in the circuit is the PNP driver transistor which must be capable of handling at least 150 volts at about 250 mA. Several ECG types meet the requirements of the circuit. Parts are Q1: ECG 32, 160V, TO-92; ECG 39, 300V, TO-202N; ECG 240, 300V, TO-92; ECG 288, 300V, TO-92; ECG 296, 300V, TO-202; ECG 374, 180V, TO-126; ECG 397, 350V, TO-39; ECG 398, 200V, TO-220. Q2: 2N4403 or equivalent. See Fig. 1.

Hugh Wells W6WTU
Manhattan Beach CA

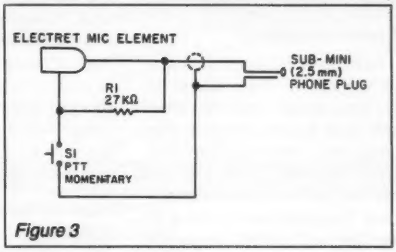

Figure 3

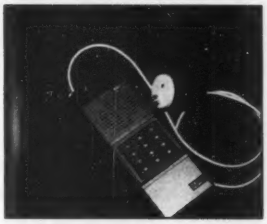

Photo A. A simple project, this external microphone adds mobile convenience to the ICOM IC-2AT.

EASY MIKE FOR THE IC-2AT

I'm so pleased with my IC-2AT HT, I wanted an external speaker for it so I could listen while riding along, without having to hold it in my hand. I bought a commercial unit, but I couldn't find a good place to mount it where it was handy and audible at the same time. Next, I thought about getting a simple external microphone.

It took me less time to come up with a workable circuit for an electret microphone than it did to find something to put it in. After digging around, I came up with a 35mm film canister and pressed it into service.

The circuit itself is merely an off-the-shelf electret mike circuit, not unlike the one contained in the 2AT itself. Using Radio Shack components, it cost about $2 to build. Parts include one PC mount electret microphone element (RS #270-090); one 27kΩ resistor, 1 sub-mini (2.5 mm) phone plug, 1 miniature momentary contact (normally open) switch (RS #275-1547), a shielded microphone cable cut to a suitable length to suit,; and one 35mm film canister. See Figure 3.

I drilled a hole in the bottom of the film canister for the shielded cable, and two through the cap for the PTT switch and the electret element. I used silicon caulk to hold the element in place behind the hole, allowing it to dry before I put the cap back on. I didn't use any foam over the hole to avoid "breath popping," but this has not been a problem.

I have been pleased with the operation of this "cheapie" mike, and find that it is a real convenience in mobile and portable operation. You can clip your HT to your belt, rather than carry it in your hand.

John R. Somers KC3YB
Crisfield MD 21817

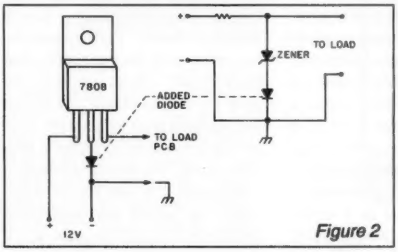

Figure 2

INCREASE VOLTAGE

The project I was making had a Sonalert-type buzzer whose operating voltage range was 7 volts to 12 volts DC. My PCB was set up for operation at 8 volts, so I put in a 7808 regulator. When I turned on the power, however, the 7808 only put out 7.5 volts. I felt I needed a better margin for the buzzer than 0.5 volts, so I added a rectifier diode and came up with 8.1 volts. This should work as well for Zener regulators. [You can "stack" (i.e., add in series to the original diodes) diodes to further increase output.—Ed.] See Figure 2.

G.R. Beckham W7FVM
St. George, UT

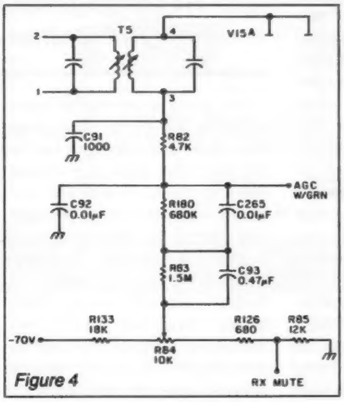

Figure 4

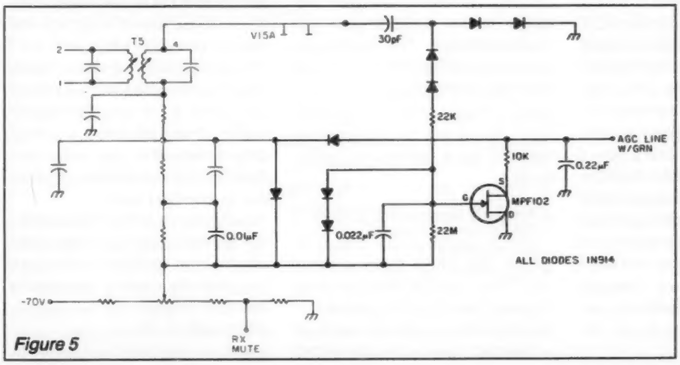

Figure 5

MOD FOR THE KWM-2

This modification changes the AGC to a hang-type and uses very few parts. It retains the fast attack characteristic. The signal causes the meter to hang. It returns to full gain quickly, about one and a half seconds after the signal is gone. The time constant of the hang-time allows the AGC to follow slow variations (QSB) in signal level. After this modification, you need to repeak T5.

Figure 4 is the circuit to which you attach the modification. That section is shown again in the screened area in Figure 5, without the callouts. The unscreened section in Figure 5 is the modification.

I also used this circuit in a Collins 75A2. The S-line receivers use the same dual time constant AGC as the KWM-2. I'm sure this modification would work with the S-line receivers, too.

Warren Walker
AC0R
Pueblo CO 81005

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Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

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How many "Hello, good-bye" QSOs have you had? Why? Poor band conditions? Crowded bands? It's hard to face up to the fact that some extra punch would really come in handy. Now, before the hate mail starts, let's get real and say, "Hello there, Earth calling." At times I have had to run a full QRP gallon—50 Watts. In emergency communications, sometimes a peanut whistle signal will just not be heard. Two Watts can really get eaten up fast on a crowded band.

With a single high-gain transistor as the active device, one should be able to build amplifiers in one's sleep. Unfortunately, that is not the case. Getting a solid state amplifier to work properly is not an easy task without some basic knowledge.

Some years ago, Doug DeMaw W1FB designed a small amplifier for the HW-7. It was called "Slippers for the HW-7." The amplifier used a Motorola MRF 499A. The original article was in the December 1975 issue of *QST*. The circuit is also in solid-state design. This stud-mounted device will produce up to 30 Watts of RF. The circuit that Doug designed produced 15 Watts with 1 Watt of drive. I built the amplifier, and it worked—sort of. Using my HW-8 as a source of drive, I was able to get over 30 Watts output into a dummy load. Later, when I removed the drive, I discovered I still had over 30 Watts output! Wow! This thing was not only an amplifier, but an oscillator, too.

I thought about keying the VCC line and using it as an all-band transmitter. Transmitting from DC to light all at the same time. How did I know the output ran from DC to light? Reports of interference to a neighbor's toaster, that's how! I worked and worked to stabilize the amplifier and achieved some success, but it never did generate the 15 Watts it should have. In a letter to Doug Stivison NR1A, I mentioned this problem. Doug also had trouble with stability and getting the 499A to generate the rated power.

Power with Stability

Working with Doug, and using his suggestions, I was able to get the rated power from the 499A, with good stability. Here is what Doug and I have learned firsthand. Put these tips to use, and you, too, will be assured of success. You don't have to have an amplifier with a 499A. These tips apply for all solid-state amplifiers, no matter what kind of transistor is used. From Doug Stivison, the following:

Impedance of the output network varies with both frequency and power level, and this directly determines the power output. That is, the impedance of a 5 µH coil might be both the correct value for 40 meters at the 8 Watt power level, and 30 meters at the 15 Watt level. Conversely, this means that what you think is the right value for 40 meters at the ideal power level is actually out in left field at the actual power level.

> ***"At times I have had to run a full QRP gallon—50 Watts"***

The actual power level is determined by the combination of all the output components, as well as the input drive level. Don't forget about all the spurs that are contained within the drive. A major unknown is the internal capacitance of the transistor. Most professional engineers concede that output networks are a "best guess." Even with a computerized design program and a lab full of test gear, they expect to do a lot of seat-of-the-pants diddling.

Doug W1FB did not give the length for L1; he just gave the number of turns. The inductance varies significantly, depending on how the turns are spaced. Eventually, I found that spacing the turns about two wire-diameters between turns made a big difference.

A Properly Resonating Circuit

C1/C2 seems to be critical to getting the whole thing working well. If the variable does not show a good, clean peak, you're not working with a properly resonating circuit. I also learned that C1/C2 do not work alone; there is a dramatic level of interaction between L1 and C1/C2. As best as I can tell, L2 is far less critical.

Doug's first attempts on 40 meters were just as lackluster as mine. All seemed fine and dandy until the antenna was connected. The SWR went 12:1. This is a classic situation we have all seen. Using a grid-dipper as a wavemeter, I found RF on 4, 6, 7, and 14 MHz. God only knows what was going on in the MF and LF ranges.

Essential Troubleshooting Equipment

It would really be grand to have a room full of test equipment for troubleshooting, but most of us don't have this. Yet, to dig out the critters, there are a few things that should be in everyone's shack. First, you'll need a good amp meter. By placing it in line, you can get a good idea of what the PA transistor is doing. Before you apply drive, connect the amplifier to the power supply.

For a Class "C" amplifier, you should see no collector current flowing. If upon firing up the power supply, you see large amounts of collector current, quickly turn it off! You've got some bad trouble. An amplifier that should produce 12 Watts output should also consume about twice that amount in collector current. In other words, a current draw of about 2 amps at 12.5 volts should produce about 12 to 15 Watts output, depending on the efficiency of the transistor. If you notice current of 5 amps, with 8 Watts output, the transistor is running away, producing all kinds of crud all over the place. After you remove the drive, current should fall to zero again. If it doesn't, you'll have to get out the second tool of the trade.

I use a small transistor radio tuned to the low end of the broadcast band. If the amplifier is producing LF and MF spurs, you'll be able to hear it in the radio. Remember to terminate the amplifier into a good 50Ω load.

Let's say that you notice nothing on the radio, but when connecting the amplifier to a tuned antenna, the SWR is way out of line. This tells you that the amplifier has critters on the output other than the required frequency. In most cases, you'll have to get your hands on a grid-dip meter or wavemeter. You can then find out what frequencies are being generated along with the fundamental one. A frequency counter can also be pressed into use here. By placing a one- or two-turn pickup loop by the amplifier, the counter will lock on and display the frequency that it sniffs out. If the counter "rolls" then there is so much crud the counter can't get a lock on it. This is a good test. So, with just a handful of common test gear, you should be able to de-bug most amplifiers.

Stabilizing a Solid-State Amplifier

How do you get a solid-state amplifier stable? That's a hard one. Here are some more tips that I have found to be helpful.

Keep the output away from the input. This is sometimes easier said than done. Use shielded cable. Place the amplifier inside an RF-tight enclosure. Bypass the VCC line going to the amplifier. Sometimes a shield of double-sided PC board placed across the top of the transistor will provide shielding between the base and collector.

Terminate the amplifier into the proper load. Don't expect good results with a so-so antenna. The antenna should provide a good load to the amplifier. Use a proper sized heat sink on the PA to keep the transistor from failing due to thermal runaway. Don't stress the mounting stud on transistors that have them. Amplifiers that are built on double-sided PC board should have both sides of the copper foil connected together in several places, the more the better.

Although I'm not an RF engineer, I've played with solid-state amplifiers enough to know you'll pull your hair out working with them. But that's half the fun, isn't it?

Doug DeMaw did a fine job on the "Slippers for the HW-7." The outcome depends on how well the amplifier was constructed. Hopefully, you won't have trouble when you build a solid-state amplifier for your QRP radios, but if trouble does raise its head, you can fall back on these tips. If you can't fix it, at least you're headed in the right direction.

Next month we'll look at some home-brew tips for your spring projects. Keep the cards and letters coming. I use them to guide the column. As always, this is your column, for the QRP operator.

Number 39 on your Feedback card

HAM HELP

Your Bulletin Board

We would like to get in touch with operators of HF rigs on boats to discuss operating problems specific to a marine environment such as mounting HF antennas on the boat, effective power regulators, shielding, etc. Specifically, we are looking for other sailor amateur radio operators in the New England region. Thanks!

Jim Charboneau KC1BB
28 Constitution Rd.
Charlestown MA 02129
(617) 242-7326

Do you have any "hidden secrets" of the PRO-2021? If you do, please contact me.

David Lansing
2 Yost St.
Johnstown NY 12095

Wanted: information and copy or photocopy of manual for a Lafayette HE 50A 10 meter transceiver. Will pay cost.

Al Wilde W8JZZ
552 T-L
Du Bois PA 15801

Needed: Vibrosender, model or type number TU217, preferably 110.9 MHz.

Joe Jatis W9CYT
1515 Sommerset Ln.
Schaumburg IL 60193

I am looking for circuit diagrams, and/or operating manuals for the following (postage and copying costs gladly refunded): Akai or Mitsubishi Model VT 100 Portable video equipment (hope to use for ATV); IMC Deluxe Model GM1211 monochrome video monitor; RCA triatic capacitor tester (no model as shown).

Ladd Sajor W2KGV
767 Lomas St.
Port St. Lucie FL 24952

I would like information on any modifications to the Atlas 210X.

Scott Liedling KS5N
7622 Evergreen Brook Way
Houston TX 77095-4026

Need info on converting late-model 440 MHz transceivers to 460–470 MHz for college class project. Any info appreciated. Will pay copy and mailing costs.

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Ron Rollinson NR8O
128 Julep Lane
Cincinnati OH 45218

I need a schematic for the Swan 350B and schematic/manual for the Swan HF 700S transceiver. Will pay any charges. Thanks.

Charlie Wallace
Rt. 3, Box 223K
Big Pine Key FL 33043

Wanted: Machine language program for the TRS-80 Model I, Level 1 or 2 (prefer level 1) to TX/RX RTTY via expansion port. Will pay nominal fee.

Frank Brinson
5113 Richland Ave.
Chillicothe IL 61523

I need a service manual or at least a schematic for an Edgecom System 3000A VHF FM 2 meter transceiver. I will pay for copying or other costs.

Chuck Crowley K5BER
215 Clower Ave.
Long Beach MS 39560

Gentlemen: I just "inherited" an *old* Gonset Communicator II, 2 meter AM transceiver! Someone removed the mike jack and didn't sketch the location of the wires. I need a schematic for this unit. If you have one, I'd be glad to pay for copying and mailing costs. Thanks for helping me get this old rig back on the air!

Bert Voth WA0PWE
802 Forest Drive
Olathe KS 66061

I need a diagram and part values for my ailing Hickock Teaching Aids Scope, Model OSK-4, and will be glad to reimburse someone for copying costs and postage.

Paul Hinkamp W8YOU
1304 Ashly Ct.
Midland MI 48640

Continued from p. 5

projects for *73*, I'll put out booklets of them.

Suggestions for Construction Projects

What can we build? Lordy! We haven't even scratched the surface with 10.5 GHz equipment. We need QRP gear for 10 meters to use with the new sun spots. We need conversions of CB to 10 meters. We need small receivers and antennas for hidden transmitter hunting. We need all sorts of simple test equipment—dippers, field strength meters, capacitor and resistor decades, Q-meters, etc.

Is anyone building outboard accessories for our commercial ham gear? How about inventing an automatic call identifier for HF rigs? How about hooking up some ICs and developing some really narrow-band communications systems?

We need lots more beacon stations on 6 meters and up so we can hear when our bands open. These beacons need automatic keying systems. Perhaps we could work up some beacon digipeaters so we could send coded pulses out periodically and listen for beacons that we've triggered to tell us where the band opening is. There's plenty to do if you'll take the time.

Our 1250 MHz band is almost unused, so how about some simple rigs and receivers for it? If our amateur TV fanatics had used 1250 instead of fighting over a single lousy channel on 430 MHz, we might have been able to keep from losing 30% of the band.

How long will the FCC hold 900 MHz for us if we keep ignoring it? It isn't like it's difficult to make rigs for this band, you know. Of course, if you feel it's more important to watch the ball games and sitcoms and rent movies, then I question your priorities. Are you throwing away time every single morning watching the *Today* show? You can keep up with the news in just five minutes. The rest of the show may be entertaining, but it isn't of much informational value.

The evening news on TV? Another five minutes will let you know what's top and the rest you can catch up on in a few days with *Newsweek*. If it's of any importance it'll be in *Newsweek*. If it isn't, the chances are you've wasted your time. Newspapers? You're joking.

Let's get those soldering pencils sharpened and start getting stuff working you can get into *73*. UHF, QRP, RTTY, I don't care . . . just DO it!

There, I haven't said a word about no-code. Doesn't that make you happy?

Ham Suers

It is difficult not to think of an amateur who stoops so low as to sue another amateur or group in less than the worst terms we can apply to a human being—but I'm trying. This is supposed to be a hobby. It's supposed to be for fun, and that has no connection with suing.

My first reaction is to ask the FCC to enact a new regulation that says that anyone who brings a lawsuit against an amateur or an amateur group involving amateur radio, have his license revoked forever. Actually, while I'm not generally a fan of capital punishment, I might go for the death penalty for ham suers. And none of this stuff like the electric chair or the gas chamber; let's get back to public hanging or perhaps something with boiling oil.

In amateur radio we have a hobby that of necessity has to be regulated to some extent by the government, since we're using several billion dollars worth of publicly-owned frequencies for our entertainment, with just enough public service thrown in (my estimate: 0.001%) to barely keep commercial interests at bay.

The FCC is happiest when they hear nothing from us. They really don't want to be bothered with rule changes or with our interfraternity squabbles. They don't want to monitor and regulate us, so if we cause them trouble and/or expense, it's likely they'll take the obvious path: get rid of us. They have enough to do with the commercial services and they don't need to waste time on us freebies.

When you get your ham license, you get the authority to start using our ham bands. In general we agree among ourselves how we'll cut 'em up, and the FCC goes along with our decisions. They'd like it much more if we could manage ourselves 100% and leave them out of it.

Self-Regulation

Indeed, I've proposed that we organize a national conference every other year with the specific purpose of updating our regulations. I suggested that interested ham clubs field two representatives for the conference. It would be molded after the International Telecommunications Union Conference in Geneva.

The first order of business would be for member clubs, those fielding conference teams, to submit their proposed rule changes well before the conference. These proposed changes would be discussed by the clubs and their delegates instructed as to the wishes of the group. These would be circulated to the other clubs for further consideration.

At the conference, each rule change would be remanded to an ad-hoc committee to consider it and come up with a compromise recommendation to present to the conference as a whole (the plenipotentiary) for a vote. The results of the conference would be enacted immediately by the FCC.

I've discussed this with several FCC commissioners and found them all to be enthusiastic about this approach. I've been assured that the Commission would find it in their budget to provide the conference with FCC legal advice so our proposed rule changes would not run into legal hurdles.

Such a system would make it possible for us to have regulations that meet our immediate needs. With the present system, it often takes years before a rule is changed, and even then, in almost every case, the rule is no longer needed.

Such a system might encourage us to develop more gentlemen's agreements in place of cut-in-stone rules. I've never been disappointed at the results of such amateur radio cooperative efforts in the past. Indeed, I've always found them to be almost excessively protective of even the smallest ham interests.

We should understand that our license does not guarantee us anything. It is a license to use the ham bands, but it does not guarantee us a clear frequency or a solid contact. It does not even guarantee a QSL.

Ham Protectors

Now, getting back to the suers in our midst, perhaps it's time for a new national ham organization to get set up primarily to protect amateurs and amateur groups against misguided hams who have the insane notion that their license has guaranteed them the use of a frequency—a repeater, clear channel, or whatever. I have no problem dealing with people who are rational, but when people are no longer rational, I get as frustrated and angry as anyone else.

If we set up a national amateur radio protective association, we could get ham clubs and groups to join it to give us the national strength we'd need to keep lawsuits from happening. I'll bet we could get some savvy ham lawyers to work with the association to bring counter-suits for harassment, for harm to the general ham good, etc., in the federal courts. The spectre of such an expensive federal counter-suit might put a chill on this suing baloney. We're a national hobby, governed by the federal government, so it only makes sense to mount any counterattack in a federal court, complete with the protection of PRB-4.

No, I don't need the aggravation of running a new national ham association. And the ARRL certainly isn't going to set anything like this up. But is that all we have, me and the League? Give me a break! If that's the only action we have in the whole danged hobby, then it's time to give every suer what he wants.

Buying Justice

Instead of setting dues for club membership in the national de-suer organization, I'd suggest a plan whereby clubs would join and agree to share in the legal costs required to keep litigation at a minimum. If the costs are so high they seem unreasonable, the clubs will drop out. But if we can get 500 ham clubs to join such an association, we'll be able to outspend even the most vicious suer—and that's how you win justice in America. It's got little to do with laws, little to do with what's right, and just about everything to do with who has the money. If you have the idea that I do not respect our legal system, you're right. It is not something of which America can be proud.

Twenty-five years ago I formed the Institute of Amateur Radio. I started it as a way to organize group ham travel. Once started, I found a lot of support for it as a source of funds to help amateurs fighting legal suits, such as tower suits, which could hurt amateur radio. We had a good deal of success with that goal, winning some big ones.

But a combination of a divorce that knocked me for a loop, an inability of the board of directors to find someone else to run the Institute, and endless attacks by the League (that spent far more fighting the IOAR than ever, taken in Institute membership dues), finally did it in.

By the time I'd gotten over my divorce, amateur radio was in a shambles as a result of the ARRL's Incentive Licensing proposal, so the Institute has remained history.

I've been gathering the names and calls of the hams who have instituted lawsuits against hams or ham groups. I'd like to list them in the magazine so you'll all know who these people are. I'll be interested in hearing from anyone who actually has a legitimate suit going. That might change my mind about such hams being cancers on the body of amateur radio.

May I repeat that a ham license is a permit to operate. It does not guarantee anything. Yes, every amateur has the permit to set up a repeater, but since this is a hobby and we have very limited frequency resources, it's up to us as a group to come to agreement on who sets up on what frequencies. And if we can't, then it's just tough.

Until the time I get into an area and don't find at least one repeater unused, with no one answering my calls, I'm not going to be convinced that we have any shortage of repeaters. In my experience—and I travel a lot—about 90% of our repeaters are terribly underused. I view the desire to set up more repeaters as an expression of ham egos out of control and not representative of any public need.

So, are our ham suers dirty, rotten scum, or do they have a legitimate case for helping keep more lawyers living in luxury?

SETI, UFOs and Amateur Radio

SETI, the search for extra-terrestrial intelligence, and the tens of thousands of UFO reports we've had, would seem to make it worthwhile for some of us to look for signs of alien communications. I say, if we can't find intelligence here on earth, let's look for it elsewhere.

But before we waste a bunch of time looking for signs of alien communications, just how probable is it that there are other civilizations out there? And if they're out there, how come we haven't seen or heard 'em yet? It's difficult to work up a computer simulation of the problem because there are so many unknowns. Are we wasting our time looking for something that may not be there?

Many scientists agree that the universe is about 15 billion years old. Fine, except that we've run into some meteors that appear to be about ten times that old. Hmmm. Oh well, just an anomaly, never mind.

And was there a big bang or not? Opinions are increasingly mixed on this, with some scientists opting for multiple big bangs, each forming its own universe and eventually separating from the others. Read *Sky and Telescope* magazine to keep up with the most recent cosmology developments. The field is in an uproar.

There's convincing evidence that life is being spread throughout the universe by an even older intelligence, and that these seeds have been resulting in the sudden springing up of various basic species of life. The seeds seem to be of a wide variety, with those adaptable to the conditions on a given planet taking hold. This line of reasoning and the data that support it may be troublesome to many religious people, who much prefer the comfort of two- and three-thousand year-old explanations over those of modern science, even keeping in mind how rapidly science has had to change its theories to keep up with developing data. *Discover* magazine has had some interesting articles on this.

But let's ignore for a moment that our universe may be of relatively recent development. We have pretty good data showing it to be about 15 billion years old. Yes, there are some problems with this. The estimated age is dependent upon the red shift of distant stars and galaxies. Now we're finding stars that seem to have vastly different ages within the same galaxies, and that's screwing everything up.

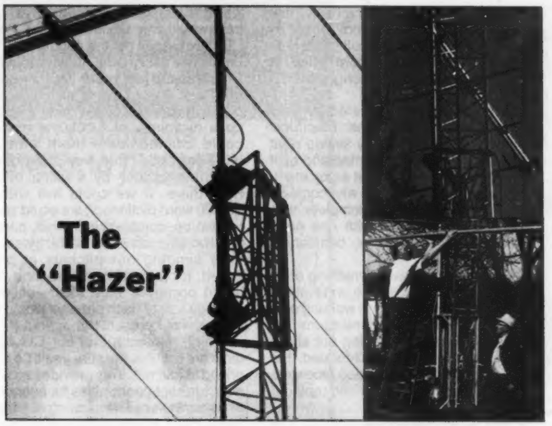
If we figure that the first stars in our galaxy started about 10 billion years ago, and we know our sun is about 5 billion years old, it's logical to expect that the first civilizations got started even before our solar system was formed. If it took us five billion years to go from a starting solar system to porno shops and repeater jamming, that's a good yardstick to apply to other solar systems, right?

It turns out that no matter how discouraging a scenario you hypothesize, with most civilizations either nuking themselves, running out of resources, or having no spirit of adventure, the universe would still have been fully occupied billions of years before our solar system even got started. See the November '88 issue of *Analog's* science fact article.

Where Is Everybody?

The computer simulations come up with millions of civilizations, organized into about 50 major cooperative

continued on p.92



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Continued from p. 90

groups. So, if the entire galaxy is already civilized, where IS everyone? And how come we don't hear 'em on the radio?

Radio is pretty hot stuff for communications, but I hope we're not so arrogant to think that just because we haven't yet discovered it, there's no better communications system possible. The probability that there are civilizations all through our galaxy, and that they are communicating, is enough to suggest that we have some inventing to do.

It's odd how scientists have always tended to think that all the basics have now been discovered. If you read much, you know that there was a move to close the Patent Office about 90 years ago because everything had been discovered.

Just look at how radio astronomy has grown in the last 50 years. Did you know that this science was developed by a ham who was curious about some anomalies? Scientists hate anomalies. They tend to dismiss them—must be bad data or something. Don't bother me. This has been a major deterrent to mind research and has a lot to do with the still primitive development of psychiatry.

Not Fit Company—Yet

If there are so many civilizations all around us, how come they're not here? Well, we don't know they're not. It's also likely that they know we're here, and they're letting us develop on our own until we're ready to join their galactic civilization. I hope you'll agree that we're not yet fit company for any intelligent group. It still isn't even at all clear that we're going to survive. Between our potential for nuclear self-destruction, and the destruction of our environment, it's iffy.

If you've read Tom Clancy's books, you'll have a better concept of how iffy things really are. His *Red Storm Rising* is a rouser about WW III, and not all that far-fetched.

Terrorism seems to be gaining ground as a minorities' weapon. How long will it be before a group finally gets their hands on a nuke? Whammo will go New York, Paris, or Moscow. Then what? Yes, I know, we'll have dozens of weary old hams trying to provide communications with Morse Code—trying to send the millions of desperately needed messages.

Getting back to communications. Since it's virtually certain that there are a zillion civilizations in our galaxy; and since we know they must have darned good communications to run something like that; and since we're not hearing 'em on the radio—ergo, they've got something better. A lot better. Maybe even faster than light speed. Some time in the next one or two hundred years, someone is going to discover this new system. And when they do, people will say, hey, we should have found that years ago. We had the hints and we ignored them.

It's in the Anomalies

I ran an article in *73* a few years ago about how some hams came across the semiconductor phenomenon and ignored it as an anomaly. They could have beaten Bell Labs to the transistor by years if they'd not been close-minded about it. I wonder if there might be some hams today who have come across something odd and ignored it.

It's getting time for us to do something new. In the past, amateur radio was always way ahead of commercial radio. We did the inventing and pioneering then, after we'd proven to the professionals, against their wills, that what we had worked. They reluctantly climbed aboard. Today, alas, we're ages behind the industry. Instead of being out front leading, we're at the tail end with our blinders on.

Many amateurs are eager to sacrifice our whole hobby to preserve 400-baud Morse Code in a day when 56,000-baud automated communications will soon be a standard for commercial communications. We're like a mob, blinded by our emotions to the realities of the 80s. When someone says "no code," a lynch mob quickly forms to hang the SOB. Just look at my neck, if you think I'm exaggerating.

The 40% zap of 220 MHz may help to bring some of the angry lynch mob to their senses. It's a cold cruel world and we're going to lose amateur radio if we don't start paying for the use of our billions of dollars worth of frequencies—over 99% totally unused, and the rest being used almost 100% for the entertainment of a small group of rapidly aging, old men.

At any rate, we know there is a far better communications system than radio. It's there, if we can discover it. And who else is there? Government and private research lab groups would be laughed at for even proposing to spend what little research money is available for such a project. Labs have to prove that their projects are going to pay off—and quickly—if they're going to get funding. This is why virtually every major advance in science has been made by amateurs.

> ***". . . we'd need maybe three channels to handle everything we've been using the 80 meter band for . . ."***

So let's stop shooting the messenger and see what we can do. If you have any ideas for areas that should be researched, let me hear from you. We may be a doddering group of old men, but we still have some sharp minds left in our old bodies. Let's put 'em to work.

Narrow-Band CW

Last month I explained how new digital technologies have made it possible for us to greatly reduce voice bandwidth, possibly allowing up to 7,000 more users than at present in our bands, yet with far less QRM. And that's without even resorting to regenerating the voice with a computer.

Now let's look at CW and see what technology holds for us there. With CW, we don't have to worry about maintaining the original voice tones and quality, so we're able to head for some serious bandwidth/time economies. After over 60 years of using CW, perhaps it's getting time for us to at least consider updating this mode.

Before I get into compression technologies, let's first consider the whole CW system. It starts with you sitting there (you don't stand, do you?) keying your rig. This sends a series of semi-decipherable dots and dashes over the air. Two generations ago most of us used straight hand keys. Then we shifted to bugs and semi-automatic keys. A few years back, as digital electronics and hundred-dollar computers took hold, most of us shifted to keyboards.

It wasn't very long ago that most of us had to sort out the dits and dahs by ear—a prisoner of our incompetence. Then electronics saved our hash, freeing us from the cacophony of chirps and beeps. Now almost all of us read our code on our Commodore VIC-20 or C64 computer screens. Long live CW, I say!

A few days ago I wandered the halls of the Summer Consumer Electronic Show in Chicago. I enjoy seeing what the Japanese have invented and built for us lately. I also almost enjoy meeting the hundreds of hams who come up to me and say hello—complete with their call letters and, with one hand firmly grabbing my lapel, bemoaning that ham radio is dying.

One chap did have something of interest—even promised to write about it. It seems that he's been working on a project for a large communications firm that is interested in getting our shortwave bands, so he's well-funded. His first step was to set up video recorders with wide-band receivers and tape our CW bands for a month.

This is an interesting approach to surveying our bands. I first ran into it when I helped operate the moonbounce effort at Arecibo a few years back. We were tuning the 1296 MHz band as best we could, making contacts all around the world. But, just to make sure, we also taped the whole band on video tape so it could be tuned later on to make sure that no signal coming through was missed.

With a month of the CW sections of 80, 40, 20, 15 and 10 meter on video tape, the next step was to set a computer to deciphering the CW signals. Once programmed, a PC clone just sat there and worked its way up the bands, copying every contact made. Each tape had six hours recorded, so it only took four tapes for each day taped.

The complete text of every CW QSO heard during the three weeks was thus decoded and printed out. The next step was to examine the contacts—charting the number in progress in every five-minute period in each band and the code speeds used. As I recall, it came to about 4,500 words, with approximately *300 words accounting for over 95% of all communications* except for operator names and locations.

One approach to updating CW might be to digitally encode our Morse and send it in short packets. These would be received at the other end and translated back into Morse—which could then either be copied by ear or with a computer.

We don't need the whole ASCII alphabet for this since we don't send upper/lower case characters in Morse. We could get by with about a total of 50 characters—which could be represented with six bits. We'd add a start bit, a parity bit, and two stop bits, for a total of 10 bits. Better yet, we could send two characters at a time and do it with 16-bits.

Callsigns could be even further encoded for economy. Almost all calls, including a portable designation for displaced hams, could be sent with eight characters. This would take four bytes of 16 bits each—and 16 bits is the way the computer world seems to be going. If we went to 32-bit bytes, our calls would only require two.

But why spell out the 4500 words we use? If we assigned a number to each English word we could just send the numbers. A word averages five letters plus a space—six characters. If we set up a dictionary of 64,000 words we could communicate them with 16 bits—one byte. That would cut down our transmissions by a factor of six right there. If we could live with a 16,000 word dictionary, we could send two words, complete with start, parity, and two stop bits in our 32-bit bytes.

By sending our packets at high speed, for a fraction of a second, we would occupy a wide band—but the average use of each channel would be far below our present throughput.

A high percentage of our CW contacts are routine, I'm sure you'll be surprised to find out. This provides us with even further opportunities for economy of transmission. The sending of a town name could easily trigger a more complete response on the receiving end which would add "QTH HRZ" automatically. Heck, we don't want to have our digital technology actually spell all our words, do we? No, I think we should maintain our CW abbreviations, just as we do on phone. Phone ops freely use the Q-code, even though it's totally unnecessary.

The whole QSL situation can be covered with one number that would translate on the receiving end into, "QSL HR 100%, PSE SND YR QSL."

The beginning of each contact could include a code that would indicate the CW speed being sent, perhaps in increments of 2.5 wpm up to 20 wpm, and then in 10 wpm increments beyond that. We could send that code with four bits at the beginning of each QSO, taking us to 100 wpm, that should be enough for even the most discriminating ear.

But, you ask, how on earth can a hundred or more contacts all use the same channel without incredible confusion? I'm sure there are a number of ways this can be done. I think I'd opt for a time assignment system. With each transmission taking about a hundredth of a second, we could have our rigs send a short marking pulse every couple of seconds to indicate that this particular time slot is occupied. Our rigs would select an unused slot and start marking it.

By channelizing our communications as we do on the VHF bands, we'd be able to avoid interference (QRM). A CQ could be sent by just sending your call/location in a time slot until someone else answers on the alternate second, and away the contact would go.

A system like this would enable us to clear out about 99% of 80 meters. Actually, judging by the band occupancy study I mentioned, we'd need maybe three channels to handle everything we've been using the 80 meter band for, and even less on the higher bands.

To satisfy our older amateurs who are worried about what will happen if there is an emergency and our commercial power goes out, we really should make everything work on AA-sized NiCd batteries and recharge them with a few solar cells. I visited a solar cell factory the other day, and they're turning out small cells that generate 1.5 watts per cell!

If we do start trying to take advantage of technology, we could end up with almost empty ham bands that would make us either get more hams to fill them or else face their loss.

C'mon, I know there are a bunch of you who have the technical smarts to get us at least into the 80s. Let's see some action—some circuits you've tested that I can publish in *73*. ■

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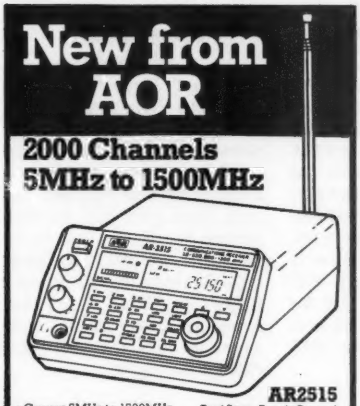

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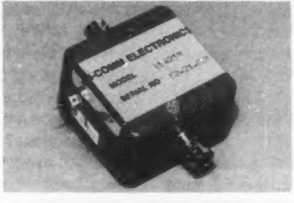

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SPECIAL EVENTS

Ham Doings Around the World

DOVER NJ
APRIL 1

The Split Rock Amateur Radio Association, Inc., is sponsoring the North Jersey Hamfest beginning at 8 AM at the Dover Armory. VE exams, dealers, flea market, tailgating, prizes, refreshments. Admission is $3, nonham spouses and kids free. Tables, $8. Tailgating, $5. Vendor pre-registration *PO Box 610, Rockaway NJ 07866.* Talk-in: 146.385/.985rpt and 146.52. Contact *Harvey Klein WA2JHT at (201) 538-1768, evenings.*

BALTIMORE MD
APRIL 1–2

The 1989 Greater Baltimore Hamboree and Computerfest, the largest multi-interest computer, amateur radio, electronics show and indoor/outdoor flea market in the Mid-Atlantic area, will be at the State Fairgrounds in Timonium. Large exhibit areas in three buildings, free parking, door prizes, food. Admission is $5 for both days, with children under 12 free. Write *GBH&C, PO Box 95, Timonium MD 21093-0095* or call *(301) HAM-FEST 24 hours a day.*

MADISON OH
APRIL 2

The Eleventh Annual Lake County Hamfest will be held at the Madison High School from 8 AM to 3 PM. All-indoor flea market, commercial exhibits, programs, prizes, and food. Admission, $4 at door, $3 in advance. Talk-in on: 147.21/.81, 222.90/224.5. FCC exams. Tables, $5 and $6.50. Write *Roxanne, 7803 Skylineview Dr., Mentor OH 44060 (SASE please). (216) 953-9784.*

LONGMONT CO
APRIL 2

The Longmont Amateur Radio Club (LARK) is sponsoring a swapfest from 8 AM to 3 PM at the Boulder County Fairgrounds. This will be a combined Hamfest and Computer Swap. For information, contact *Bob Dornan WA2EKU, 1106 Fordham St., Longmont CO 80501. (303) 651-3613 or Ken Parker W0ONF, 1221 Aspen St., Longmont CO 80501. (303) 772-4719.*

CALVERT CITY KY
APRIL 2–3

The Marshall County Amateur Radio Association will operate KM4GS in conjunction with The 146th Annual Tater Day at Benton, Kentucky, from 1700Z on the 2nd to 2359Z on the 3rd. Operation will be in the lower 25 kHz of the General portion of the 80–10 meter bands and the 10 meter Novice band. For a special "TATER DAY" QSL, send QSL and SASE to *KM4GS, PO Box 917, Calvert City KY 42029.* Special QSL to SWLs for report and SASE.

TEANECK NJ
APRIL 8

Ham radio flea market sponsored by the Chestnut Ridge Radio Club will be held at the education building of the Saddle River Reformed Church in Upper Saddle River. Table, $10 for the first, $5 for each additional table. Tailgating, $5. Admission, $1. Contact *Jack Meagher W2EHD, (201) 768-8360.*

COLUMBUS IN
APRIL 8

The Columbus Amateur Radio Club Hamfest will be at the Bartholomew County 4-H Fairgrounds from 8 AM to 2 PM. Talk-in is on 146.79 minus 600 Hz. *David Mann KA9UUP, 458 N. Country Club Road, Columbus IN 47201. (812) 342-6302.*

FRAMINGHAM MA
APRIL 9

The Framingham Amateur Radio Assn. will hold its annual spring flea market and license exams at the Framingham Civic League Building. Admission $5 for Early Bird Buyers who come before 10 AM. Admission after 10 AM is $2. Tables, $12 each, includes one free admission. Preregistration required for the flea market and exams. Talk-in on 147.75/.15 Framingham Repeater. For information, contact *Jon Weiner K1VVC, 52 Overlook Drive, Framingham MA 01701. (508) 877-7166.*

BRAINTREE MA
APRIL 9

The South Shore Amateur Radio Club of Braintree willhold its annual indoor flea market at the Viking Club from 11 AM to 4 PM. Tables, $10 each, includes one free admission if paid before April 7 to *Hal Jones WB1ABM, 48 Saning Rd., N. Weymouth MA 02191.* Tables $12 after the 7th. Checks payable to the South Shore ARC. Doors open to vendors at 9 AM with entrance fee of $1. Free parking. Questions? Call *Hal, (617) 335-5777, evenings.*

FERGUS FALLS MN
APRIL 15

The Lake Region Amateur Radio Club is sponsoring its annual Hamfest from 8 AM to 2 PM at the Otter Tail County Fairgrounds-Hockey Arena. VE testing, packet meeting, Army Mars State Meeting, satellite meeting and demo, commercial dealers, flea market, concession stand, and more. Registration, $4 at door, $3 in advance. Tables, $4. Call *(218) 826-6274* or write *Keith McKay N0FKF, Rt. 1 Box 46, Battle Lake MN 56515.*

LAWTON OK
APRIL 15

The Lawton-Fort Sill Amateur Radio Club will hold its 41st annual Hamfest at the County Fairgrounds from 8 AM to 5 PM. No preregistration necessary except for table space. Talk-in on 147.39/.99. Contact *Claude R. Matchette, 3411 NW Atlanta Ave., Lawton OK 73505. (405) 357-5870.*

CHARLESTON WV
APRIL 15

The Tri-Counties Ham Club and the Kanawha Amateur Radio Club are sponsoring the annual WV Area Hamfest and Computer Show at the Charleston Civic Center. Admission is $5, tables are $6 each. AC power is $12. Walk-in VE exams and alternative programs. For dealer and flea market information, write *PO Box 1694, Charleston WV 25326,* or phone *Bill Hunter K8BS at (304) 744-2650 or Lovell Webb at (304) 342-7247.* For other information, write *PO Box 9076, So. Charleston WV 25309* or phone *Doug Sweeney at (304) 766-6655.*

BIRMINGHAM AL
APRIL 15

Foxhunt! Three transmitters on 2 meter FM will be hidden in Oak Mountain State Park. Trophies to the top finishers and handsome certificates for all participants who complete the hunt. Map and RDF session before the hunt. Talk-in on W4CUE/R, 146.880 MHz. Camping. Contact *James Pilman KA4ZQA, (205) 991-7762, evenings. Leave packet messages for KA4ZQA at W4CUE PBBS in Birmingham.*

HUDSON NH
APRIL 15

At 9 AM on the 15th, the I.R.S. will hold a flea market at the Lions Club Hall. The Interstate Repeater Society, a Derry, New Hampshire, based club plans a non-taxing time at their annual flea market. Admission, $2 (includes raffle ticket). Tables, $10 each. Talk-in on 146.850 and 224.460 I.R.S. repeaters. For reservations, contact *Wayne KA1MKH, (603) 895-9033 or Chan KA1OU, (603) 497-4333.*

SPOKANE WA
APRIL 15–16

The Twelfth Annual Inland Empire Radio Hamfest will be held at a carpeted, air-conditioned Convention facilty this year. It will feature an evening Banquet, an Awards Breakfast, Forums, Flea Market, Commercial Displays, prizes, seminars, swap tables, VE exams. Admission is $5 for both days. Contact *Ivan Brown KF7PU, W. 728 Spofford Ave., Spokane WA 99205. (509) 328-7961.*

TUCSON AZ
APRIL 15–16

The Old Pueblo Radio Club will operate W7GV, the oldest continuously active callsign in Arizona, from 1500Z the 15th through 2400Z the 16th to commemorate 60 years of worldwide amateur radio operation on the 10 meter band. Operation will be over the entire 10 meter band, including CW, phone, FM, and packet gateways. For a QSL, send your QSL and SASE to *W7GV, Box 42601, Tucson AZ 85733.*

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CAMBRIDGE MA
APRIL 16

TAILGATE electronics, computer, and amateur radio FLEA MARKET on the 16th, from 9 AM to 4 PM. Admission, $1.50. Free off-street parking. Tailgate room for 200 sellers. Sellers $6 at the gate, $5 in advance, includes one admission, set-up at 7 AM. Talk-in on 146.52 & 449.725/444.725–p1 2A–W1XM/R. Sponsored by the MIT Radio Society and the MIT Electronics Research Society. For space reservations or further information, call *(617) 253-3776.* Mail advance reservations before April 1 to *W1GSL, PO Box 82 MIT Br., Cambridge MA 02139.*

LEBANON PA
APRIL 16

The Appalachian Amateur Repeater Group (AARG) will hold their first Hamfest and Computer Show at the Lebanon area Fairgrounds. General admission is $3; nonham spouses, YLs, and kids free. VE tests (preregistration only), tailgating ($2/space), indoor tables ($5 with electricity, $3 without), prizes, vendors, parking. Talk-in on 146.04/.64 and 146.52/.52. *ARRG, Homer Luckenbill WA3YMU, 105 Walnut Street, Pine Grove PA 17963. (717) 345-3780.*

ALCATRAZ ISLAND
APRIL 22

The Sacramento Amateur Radio Club, operating station W6AK, will operate from the bakery of the old Alcatraz Prison from 1700 to 2230 UTC. Suggested frequencies: SSB—7.270, 14.300, 21.400, 28.450; CW—7.125, 14.05, 21.085, and 28.150. Also, 2 meter FM will be on 146.52 as well as on a 2 meter packet station. QSL from "The Rock," SASE please. *SARC, PO Box 161903, Sacramento CA 95816.*

NEBRASKA CITY NE
APRIL 27–30

The Nebraska City Amateur Radio Club will operate K0TIK from Arbor Lodge, the home of J. Sterling Morton, the founder of Arbor day. Operation will be on the upper portion of the general class phone bands, 80 to 15 meters, and the upper portion of the 10 meter Novice phone band, from 1400Z on the 27th to 0000Z on the 30th. Send SASE to receive certificate suitable for framing. Use an 8½x11 SASE to receive unfolded certificate. Send QSLs to *Barbara Nihart, President, Nebraska Amateur Radio Club, 7731 Holdrege St., Lincoln NE 68505.*

DAYTON OH
APRIL 28

The Dayton/Cincinnati Chapter 9 QCWA (Quarter Century Wireless Association) will hold its Annual Banquet in conjunction with the Dayton Hamvention at Neil's Heritage House. COD Bar at 6:30, dinner at 7:30. Tickets are $13 each. Contact *Bob Dingle KA4LAU, 657 Dell Ridge Drive, Dayton OH* for tickets. Progress is underway for an interesting speaker for the evening. Come and join the fun. QCWA membership not required.

DAYTON OH
APRIL 29

The Miami Valley FM Association's 20th Annual B*A*S*H will be on Friday night in the Madison Room of the Hara Arena and Conference Center at 7 PM. No admission, continuous entertainment. Awards and dinner. *Miami Valley FM Association, PO Box 263, Dayton OH 45401.*

Special Events are listed free of charge as space permits. Please send your Special Event to *73 Magazine* two months before the monthly issue you want it to appear in. Please provide a concise, typed summary of essential information about your Special Event.

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LETTERS

From the Hamshack

Maritime Net

In response to the letter from KA4WWG/MM3 in the December issue, I tuned in the Maritime Net on 14.313 MHz on Sunday morning, 18 December. All I heard for about two hours was people calling one another nasty names and making whistles and noises. I don't see how 14.313 could be of any use to anyone with all those long-winded, vulgar people on there. **Capt. Steve Smith, SWL**
Sunrise FL 33326

Steve—You must've caught the net at a rare time. The Maritime Mobile Net is noted for its efficient operation and its courteous participants. Keep listening!
. . . de NS1B

Epitaph Idea

While I am far from threescore and ten, when I become a silent key, I want my callsign on the tombstone. My callsign is just as much my identity as my name.
Steven O. Putman N8ZR
Fairborn OH 45324

Steve, are you laying some early plans for that great celestial DXpedition? . . . de NS1B

Invest in Ham Radio's Future

I find myself in total agreement with your remarks in the November "Never Say Die" column. I'm not currently active in ham radio, but am working on my Novice ticket. My renewed interest has been related to the new voice privileges as well as to a recent friendship with a ham operator. Although it should be obvious to anyone that the code is the main deterrent preventing that major increase in newcomers, it's not going to stop me from pursuing my license and encouraging others into the field. I would like to offer a couple of simple but effective ideas on how to stimulate interest into the arena of amateur radio.

I can't speak for other areas of the country, but around here anyone with questions about ham radio or looking for any help or advice on how to get started would be left out in the cold. There are no listings in any section of the phone book or classified ads. And if one were to monitor one of the local repeaters, you would get a very comprehensive update on ham news and calendar events, but no phone number that might put an interested person on the outside in contact with one on the inside.

Even access to the latest amateur radio publications is limited. This could easily be prevented if someone who is truly concerned about the preservation of ham radio were to sponsor a one-year subscription to *73*, to be displayed on the shelf of that local library.

Let's take advantage of the opportunities that would expand the number of amateur radio enthusiasts. In some cases, it would take less than 1 percent of one's equipment costs to invest in the future of amateur radio and in the future of our young people's minds.
Jeff Foster
Wyoming MI

Another Vote for No-Code

As a subscriber, I enjoy your magazine immensely, but I have written to convey my views as an "aspiring" amateur who, by choice, has yet to be licensed, thanks to the unyielding FCC code rule. Although I may not be qualified by amateur standards to judge the issue of a possible no-code license, I am qualified to have an opinion and, accordingly, I regard code as tedious, boring, and irrelevant to many aspects of amateur radio.

Our Canadian friends have recently established a precedent with their no-code Novice license which promises to attract many newcomers to the hobby. So, what is the big problem with the USA doing likewise? Is it the amateur community or the FCC (or both) who oppose a no-code license?

Several times I have heard the argument that the present code rule keeps so-called "undesirables" off of the amateur bands. Maybe, but this type of elitist reasoning, combined with the rules violations that I often hear on 10 meters, makes me wonder who the "undesirables" really are.

There are many talented 11 meter enthusiasts who could contribute to the collective pleasure, diversity, and enhancement of ham radio were it not for the archaic code regulation which they simply refuse to be force-fed, just to get a "ticket."

Oh well, someone once told me to find the grace to accept that which I cannot change, so, as the main characters in this code issue spew forth their glut of debate, I will comfort myself with continued 11-meter international contacts using 4 Watts and a Jo Gunn "Killer 8" antenna . . . without a "ticket!" 10-4?
Tom Bumpous ("Ironman")
Captain, USAR
Southwest Florida

Take Your Wife to Dayton!

This is a message to all those hams who, each year, kiss their wives good-bye, and then drive off to Dayton, to the largest congregation of ham radio operators in the world. And, they do so without the slightest regard to the storm cloud over her head.

Next year, take your wife along! There are two good reasons. First, she will enjoy it so much that she will overlook the numerous purchases you might be making. Secondly, she might become interested enough to become a ham herself, and share in the thrill of purchasing all those "goodies." Chances are, she'll be so thrilled with the Hamvention that she will also overlook the many Dayton shopping areas and leave the credit card intact. Intact enough for you to purchase any amount of the latest in electronic wonders.

The dazzle of Dayton begins when one realizes just how well organized the Hamvention is. No matter how uninterested you might be in the "di-dahs" and "da-dits," one can't help but be impressed.

Dayton also abounds with pleasures to be shared during those off-Hamvention hours. The city is laden with bike trails which will lead you around or out of the city. There are restaurants for every taste and, in the spring, the arts are in full bloom.

We returned to Dayton last year for the third time and found the event to be as delightful as ever. Ladies activities were, as usual, well organized and displayed a wide variety of creativity and hard work. For those who preferred to educate the mind, there were talks on genealogy, total health, walking for fitness, and stress and relaxation techniques.

And, wonder of wonders, I found myself looking over the forums suggested for those in the world of amateur radio. Always of particular interest to me are the workshops led by Wayne Green W2NSD, who is as adamant against smoking as both my husband and me.

I found myself wandering through the flea market displays totally amazed at some of the up-to-date equipment shown there. I watched, I listened, and I realized that some tiny seeds of interest were perhaps beginning to sprout. Who knows, by the time the next Hamvention rolls around, I might have my own call letters and it might be me who breaks the budget by purchasing the latest piece of equipment so necessary in the ham shack.

So, gentlemen, believe me—it's a "no win" situation if you leave your wife at home. She'll be spending money on her own local shopping trips while wondering why it is that you just had to have that latest piece of "junk." And, she'll certainly not come even one inch closer to realizing why you have this obsession with talking into a mike.

Taking your wife to Dayton might be just what any marriage counselor would order!
Linda Williams
Bedford PA 15522

Faulty Rigs?

During the recent CQWW phone contest, it seemed that many American amateurs had faulty rigs. The frequency readout apparently didn't give hams the proper frequency on the 10 meter band. This problem showed up only when the actual frequency was less than 28.300 MHz. When informed, most Americans were shocked or surprised to hear that they were out of band.

Sarcasm aside, in the past week on 10 meters, I counted 25 different American stations working or calling other stations on phone below 28.300. Too, I lost count of the number of times US CW ops informed me that *I* was out of band, QRMing beacons and CW ops. One station (a KD5) even cursed me for my flawed operation!

Why do I spend much time on 10 meters on phone below 28.300? Because I am a Canadian operating in Canada! We are allowed to operate phone from 28.100 to 29.700 MHz. When you think we are out of band, the truth is that you are (when on phone). When you throw a voice-mode signal on top of us, you violate your laws.

Not everyone is governed by FCC rules. Please remember that other countries have different rules! **Allen Linville VE6BEQ**
Edmonton, AB T5T-5H7
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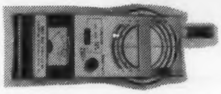

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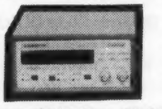

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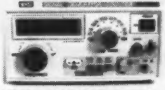

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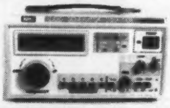

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- ✓ Low distortion
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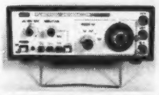

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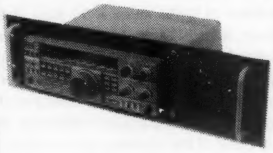

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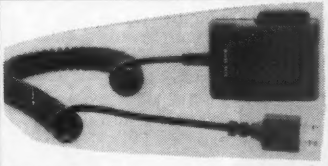

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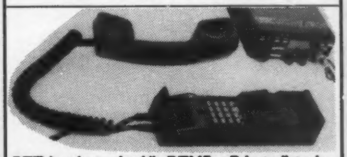

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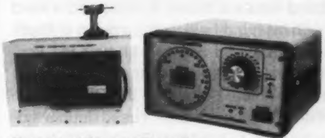

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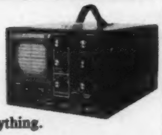

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TECH TIPS

Pearls of Tech Wisdom

For the Seeing Impaired

A blind amateur friend of mine had a hard time with his hand-held. I took a piece of Plexiglas ⅓" thick and cut it to fit over the keyboard. Next, I marked over each key and drilled ¼" holes. I mounted the Plexiglas so that it didn't touch the keys. I used double-sided sticky tape to hold the Plexiglas in place. Now the blind amateur can feel the holes, and push the buttons with his pen. The hand-held I did this on was the Yaesu 209AH, but I don't see why you can't make it work on other radios.

Garnet McKenzie VE6CFX
1746 17th St. S.E.
Medicine Hat, Alta.
Canada T1A-2B2

Improvement on the TEC-200 Process

Relative to the excellent article by W.C. Cloninger about making PCBs (August '87 *73*), I would like to focus on an improvement of the TEC-200 process described therein.

If you have any problems when transferring the circuit pattern with a hot iron, try the following method:

1. Put the film with the photocopied pattern onto the copper-clad board and fix it at one end with an adhesive strip.

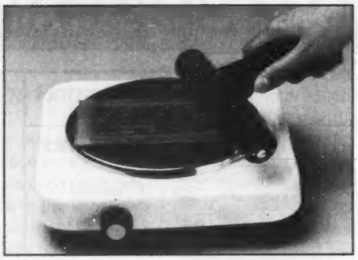

Photo A. Transfer the circuit pattern with a rubber roller.

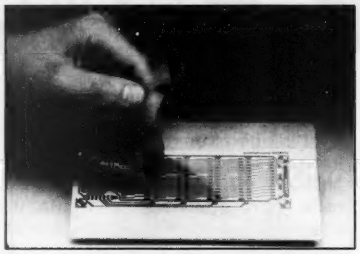

Photo B. After the board has cooled, pull the film off slowly and carefully.

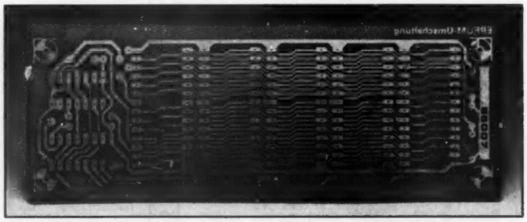

Photo C. The finished board—very clean and professional-looking.

2. Put this copper-clad board on a heating plate or on a hot iron turned upside down, and heat the board to 130–140°C.

3. Transfer the circuit pattern with a rubber roller. Applying slight pressure, roll it to and fro (see Photo A). Such a roller is available from photographic or art and craft suppliers.

Using this technique, even very fine pattern lines will be perfectly transferred. After the transfer stage, when the board has cooled, pull the film off slowly and carefully (see Photo B), leaving the circuit pattern adhering to the board. Now the board is ready for etching.

The quality of the finished board speaks for itself (see Photo C).

Dr. Roland Milker DL2OM
Finkenweg 14
5457 Oberhonnefeld
Germany

Easy Precision Resistors

Paralleling or series-ing resistors to get non-standard values can be frustrating. Here is a quick and easy way to get any resistance value you want, of any wattage, with its tolerance limited only by your ohmmeter.

Your electric drill, rotary engraving tool, or whatever similar tool you have, and a common grinding bit or steel cutter are the only tools required. If you have none of these, you can do the job by hand with a small round file.

Here's how: Select a composition or carbon resistor of lower value than your target resistance. Lay it flat on a solid surface with ohmmeter leads attached. Grind away the outer surface of the center of the resistor body in one spot, making a nice concave niche. As you approach the actual resistance element at the core of the resistor, go carefully. Monitor the ohmmeter, which will rise in value as you remove bits of the element. Go slowly so you do not overheat the element, giving a wrong reading.

When your ohmmeter indicates the target resistance, stop grinding and give the resistor a few seconds to stabilize. If it now reads the proper value, coat the groove with clear fingernail polish for water resistance.

I have successfully used this technique and have experienced no long-term ill effects. The whole process takes about three or four minutes.

Bill Bibings W8DZQ
260 Water Street
Otsego MI 49078

Have a Tech Tip?

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Huge pileups, big city QRN, no spare parts, and a long way to anywhere. You probably couldn't find a better test of the new SB-1400 All-Mode Transceiver than Heath's expedition to Taipei in the Republic of China.

When working DX, you need sensitivity to dig for the weak ones, but still need dynamic range so the guy down the block doesn't clobber you in the middle of a QSO. Sure, the SB-1400 worked the S9 + 30 signals, but out of the pile-ups it also worked a number of stateside stations running 5 watts or less! And that's not bad for a short path distance of 7600 miles!

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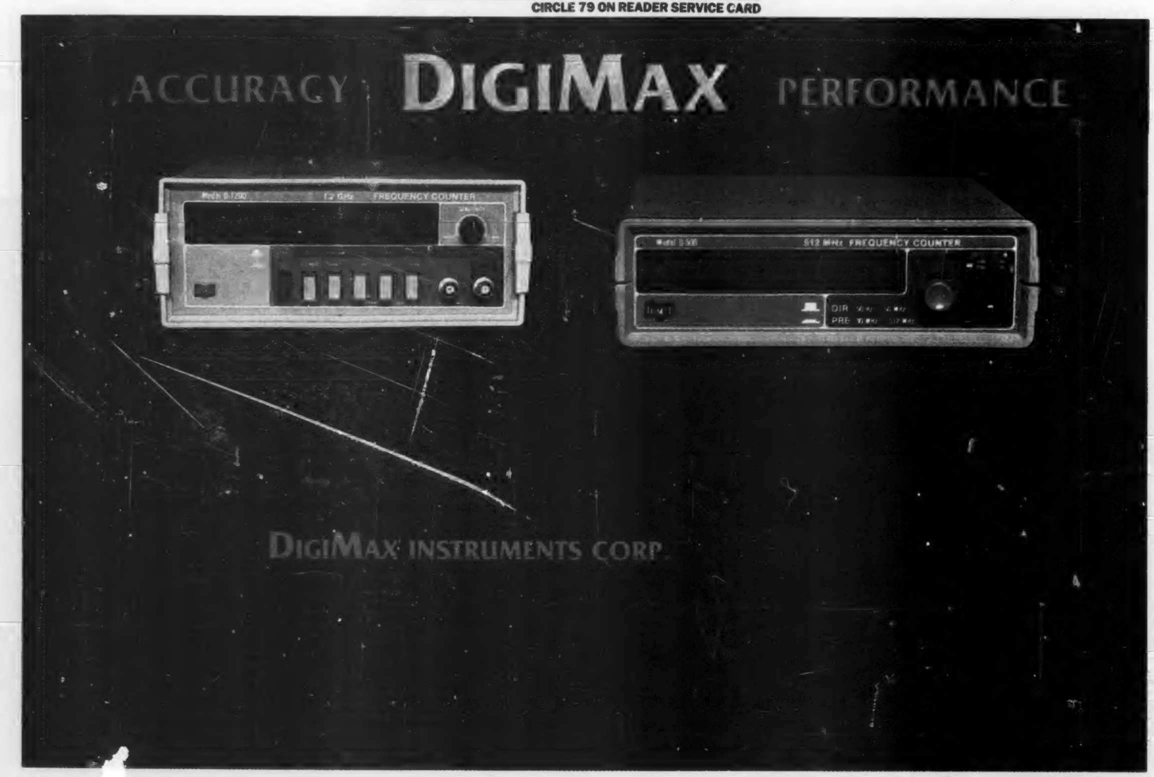


CIRCLE 342 ON READER SERVICE CARD

Number 37 on your Feedback card

73 INTERNATIONAL

edited by C.C.C.

Notes from FN42

You may recall being promised a **list of Hambassadors.** *If you do remember, please be patient. It will appear as soon as you stop sending in interesting stuff that takes up all the space—or sooner.*

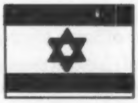
When it does appear, at least two new names will be on the list: An **Australian,** *from whom we expect final OK anytime, and Woodson Gannaway N5KVB/EA—not N5KUB/EA as we mistagged him in his first appearance here, in February. His home call is from Arkansas: "We sold my welding business to move here* **[Canary Islands]** *as Bahá'í pioneers [two years ago]. My dream of being a ham started in the late 1950s when a sympathetic friend lent me a BC-348 receiver during an extended childhood illness. It took me nearly 30 years to do something about it (and I still remember using the BFO to understand SSB). I'm teaching English and learning to make the distinctive Canary knives the old-fashioned way here. I expect to start giving guitar lessons next year, after I brush up a little more. Oh, yes; in the U.S. I also abstracted a lot of technical articles for the American Society for Metals . . . I look forward to [being a Hambassador]." Woodson will cover events in the Spanish-owned Canary Islands and also be Honorary Hambassador for Spain—honorary because he will "retire" when (if) a Spanish national volunteers for the post.*

Italy *was honored recently when Commission member (of the 17-member European Commission for the* **European Economic Community—the EEC**), *Sr. Filippo Maria Pandolfi, was named Commissioner for R & D and telecoms and information technology. We will be much interested to hear (from anyone, anywhere) of any developments in (or affecting) any of the 12 member nations of the EEC, which will have an impact on amateur radio—there are bound to be such developments between now and the end of 1992. That is when it is anticipated that Europe will have become a very special, united, community.*

April calendar. Special calendar note about Japan: *April 29 is the holiday honoring the birthdate of the late Emperor Hirohito. This will be a good day on which to express sympathy for Japan during any QSO. Year One of the Heisei era ("Achieving peace on heaven and earth,"—see characters for this at left) began on Sunday (10 a.m. EST, January 7) under Emperor Akihito.*

平
成

Other April occasions for mention during QSOs: 1—Youth Day, Benin; 2—Malvinas Day, Argentina, International Children's Book Day; 3—National Day, Guinea (9th for Sierra Leone, 27th for Afghanistan and Togo); 4—Liberation Anniversary, Hungary, Independence Day, Senegal (18th for Zimbabwe); 5—Arbor Day, South Korea; 6—Victory Day, Ethiopia (24th for Togo); 7—World Health Day, Womans Day, Mozambique; 11—National Heroes Day, Costa Rica; 12—National Redemption Day, Liberia; 14—Pan American Day, and Happy New Year, Bangladesh! 15—Military Regime Anniversary, Niger; 16—Queen's Birthday, Denmark, National Secretaries Week begins, USA; 17—Evacuation Day, Syria; 19—Republic Day, Sierra Leone; 23—St. George's Day, England; 25—Liberation Day, Italy and Portugal, Anzac Day, Australia and New Zealand; 26—Union Day, Tanzania; 27—HAPPY BIRTHDAY, SAMUEL F. B. MORSE! (FB!); 28—Arbor Day, USA; 29—Emperor Hirohito's Birthday; 30—Queens's Day, Netherlands, King's Birthday, Sweden.



ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
Negev Mobile Post Office
85530 Israel

This year's special operation for the Spring by the Israel Amateur Radio Club takes on an interesting historical twist. Between the years 1099 and 1291, the Crusaders ruled this country and set up a series of fortresses from the Red Sea on up into Lebanon. Today, ruins of these massive fortifications and castles can be found in strategic places all over the land and are well-known to those who enjoy excursions and touring in Israel.

One hundred hours of IARC operations in April will take place in four different such places: Yehiam in the Galilee, Caesarea on the Mediterranean coast, Belvoir (Kikhav HaYarden) overlooking the Jordan River valley south of the Sea of Galilee, and Ashkelon in the south, also on the Mediterranean. In most places there are youth hostels or kibbutz guest homes, so those who do the operating will enjoy socializing during the event; and visitors from abroad will be most welcome.

At the IARC raffle of gear, for the benefit of the club treasury. L to R: Naomi 4X6DW, Tuvia 4X4GT, and Yankele 4X4AH.

The operation will start at 0800 UTC on Friday, April 21, and will last exactly 100 hours to 1200 UTC, Tuesday, April 25. Each station will have a special callsign, and a certificate will be available for those contacting all four stations. [*Specific information was not available at press time.—CCC*]

Israel Repeater Update. Visitors from abroad are most welcome on our repeaters, most of which need either a 192.8 Hz or 91.5 Hz PL tone to access them. (For reciprocal licensing details see the information given in the December, 1988, "73 International" column.) VHF repeaters have a −600 kHz shift, 70 cm shifts are 7.6 MHz down (see box for list). The packet network is on 144.675 MHz, with very wide coverage through various digipeaters around the country (see the following paragraphs).

The Israeli Packet User's group had its second annual meeting in December, in Natanya. (Thanks to Shlomo Goldstein 4X4LF for the following information.) Bentzi 4X1IL presented a resume of 1988 activities. More than 80 stations are on packet and three digipeater stations are in operation—4X4HF in Haifa, 4Z4SV in Shoresh Village near Jerusalem, and 4X1IL in Herzlia, which

ARMENIAN EARTHQUAKE

A Roundup of Information As It Comes In

From Ed Kritsky NT2X. Our Hambassador for the USSR, Gennady Kolmakov UA9MA, became involved immediately. Look for a full report for this in a future issue.

From Ron Gang 4X1MK. Along with all the international aid pouring into earthquake-stricken Armenia, three Israeli Air Force Hercules transport planes flew in the Israeli assistance team. Our people included medical staff who set up a field hospital, and a crew of evacuation experts who had already been seasoned by experience in extracting people from under collapsed buildings in both Lebanon and the Mexican earthquake disaster.

Although our small country's contribution to the huge efforts made to save lives was quite limited relative to the scope of the operations, the ancient Talmudic proverb states, "He who has saved but one life, has saved an entire universe." And indeed, the Israeli evacuation and medical teams' work was far from insignificant, as was duly noted by the Soviet news media.

Amongst the crew members was Yaron Kedmi 4X6AJ, who was heard on the skeds as 4X6AJ/UG6, relaying messages back home on 20 and 40 meters. It is interesting to recall that a year ago Soviet amateurs still were not permitted to speak with us, Israel having been on the USSR's banned list since 1967. Now, with the apparent dawning of a new enlightened age, things are changing rapidly as we witness increased international cooperation and understanding.

ISRAEL'S REPEATERS

VHF (−600 kHz shift)

145.300	Haifa RTTY, FM
145.325	Beersheba
145.350	The Galilee
145.375	Tel-Aviv
145.400	Natanya
145.600	The Coastal Plain
145.625	Jerusalem
145.675	Haifa
145.775	Tel-Aviv

Open Access 70 cm.

(−7.6 MHz shift)

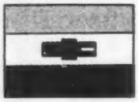
438.650	Tel-Aviv
438.600	Haifa

also acts as an HF gateway for the VHF national network. Two more are planned, one in Safed to cover the northern region, and the other in Mitzpe Ramon to cover the south all the way down to Eilat, thus covering the entire country. The IARC has been of great financial assistance, and a UHF link is planned to ease the traffic on 144.675—and also to allow the Novices, who are relegated to 70 cm., to get in on the fun.

Jim Stone 4X1RU described the operation of his BBS, which is the packet link between the Far East and Europe and North America and is averaging 70 bulletins/messages a day. He explained the problems encountered using packet on HF and detailed the experiments he is carrying out in an effort to solve them. Naftali 4Z4RM outlined the problems of some models of TNCs and recommended installation of the MF-10 filter in those not already using it. Ofer 4X6OJ described the AX.25 protocol's deficiencies, and ways of overcoming them.

Peleg Lapid 4X1GP discussed how bulletins and messages arrive at the BBS via HF, various information networks, and satellite networks. The new PACSATs due to be launched this year will add a new dimension to packet operation, and their store and forward capability should enable them to replace the present HF links.

Commemorative cups were presented to Jim 4X1RU and Yossi 4X6JP for their outstanding achievements in advancing packet radio in Israel, and there was general discussion about the need for portable packet in such situations as the Armenian disaster. [*See earthquake information box in the Roundup section, above.—CCC*] A need for assistance for hams wanting to get into packet was expressed; possibly a course can be organized for weekly meetings.



SOUTH AFRICA

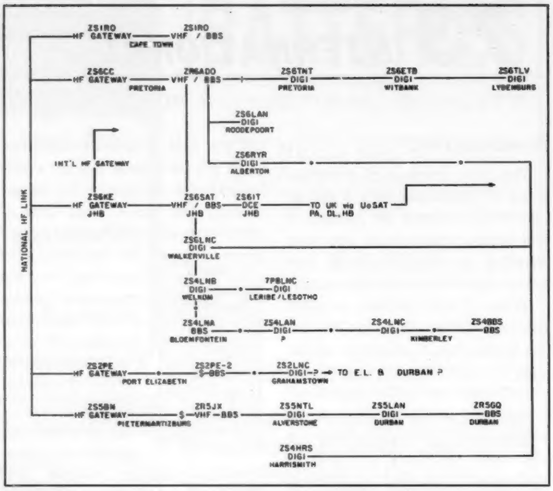
Peter Strauss ZS6ET
PO Box 35461
Northcliff, ZA-2115
Republic of South Africa

Packet Radio in South Africa. The origins of Packet Radio go back to two organizations: SAATI and SAAMSAT. SAATI, the South African Amateur Telecommunications Institute, started as an organization promoting RTTY, distributing surplus RTTY equipment, and offering kits and projects. SAATI now offers TNC kits and operates a digipeater, and its members operate a BBS.

SAAMSAT, through the international connection with AMSAT NA, AMSAT UK, AMSAT DL and the University of Surrey, became involved in the DCE project linking the ZS6SAT BBS in Johannesburg via UoSAT 11 to the BBS world in the UK and Europe.

The 2-meter user-accessible BBSs in Cape Town, Johannesburg, Pretoria, Durban, and Port Elizabeth are linked via HF, and digipeaters in the metropolitan areas enlarge the coverage. Projects on the drawing board are a link from Johannesburg to Lesotho (7P8), and a link from Johannesburg/Pretoria to Durban. Further BBSs are presently under construction. User access is via 144,650 and 144,675 MHz.

Four digipeaters operate in Level III mode with the balance still in Level II. As traffic density increases, most can be expected to be upgraded to Level III. The introduction of backbone links with higher baud rates will follow. Special permission to use 9600 baud for the linking of such digipeater sites has already been granted by the license authority. Maybe 10 GHz link channels with multiplexed data and voice can be implemented before the end of 1990.



South Africa/Lesotho packet network chart. (Existing KAM to upgrade to MBL BBS.) Information compiled by ZS6ET as of September 27, 1988. Symbols are: —— link, $ BBS, –*– proposed link, –$– proposed upgrade, –?– uncertain link.

In addition to the DCE link, the expansion of HF data exchange with other international HF BBSs is sought on a regular basis. The lack of HF BBSs in Africa, and often marginal propagation conditions towards the Far East, Europe, and the USA make the linking through HF on a reliable basis a difficult task for sysops in South Africa. Until his return to the USA during June, 1988, an amateur located in Tanzania provided a very valuable BBS for Africa.

The liaison between SARL, SAAMSAT, and SAATI in the field of packet radio is conducted through the Packet Radio Working Group (SARL PWG). Meetings are usually held once each month at the Johannesburg Amateur Radio Center (JARC). Such meetings prevent the duplication of services and projects and encourage the pooling of resources and manpower. Frequency planning proposals for packet applications are made and, in the case of the Transvaal Province with its high population density, forwarded to the TTCC, the Transvaal Technical Coordinating Committee. The TTCC is a SARL Interbranch Committee planning the use of repeater frequencies.

If you would like to see more facts about South Africa please write to me. I have a FREE video film in NTSC VHS and BETA available. The airmail charges and packing are only US$10. *Sorry, no personal checks can be accepted!* Please indicate the standard of your choice when requesting your copy.

GOLDEN CITY AWARD
(Certificate Illustrated last month)

The Golden City Award is issued to applicants who have made the specified number of two-way contacts with stations in the Greater Johannesburg Area (KG43). DX amateurs, SWLs, require five contacts. Endorsements may be applied for (CW, SSB, EME, RTTY, Satellite, SSTV, etc.). No time restrictions.

The cost of the award and airmail service is US$5 or 10 IRCs. Submit certified logs to the Awards Manager, SARL Johannesburg Branch, PO Box 2327, Johannesburg 2000, Republic of South Africa.

1989 INTERNATIONAL DX CONVENTION

April 21, 22, 23, Visalia, California

Sponsored by the Northern California DX Club and the Southern California DX Club, Holiday Inn, Plaza Park, Visalia. Pre-registration deadline (US$40 rate) March 20 postmark; US$45 thereafter. Holiday Inn Convention Rate rooms until April 6—call Area Code 209, 651-5000. Send registration fee to **Dave Engle KE6ZE, 1063 Summerwood Court, San Jose CA 95132.** Chairman: Bill Zachman W6TPH. Other Committee members: W6VG, KD6AZ, WB6WKM, KN6K, N6ST, K6TMB, KA6W.

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HPTG-2100 / -4000 / -6700 Cable....$0.30 / 0.50 / 0.70 /ft.
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We stock Andrew Heliax & Connectors.
Full line of Amphenol connectors.

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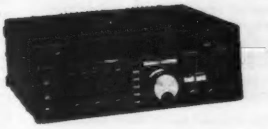

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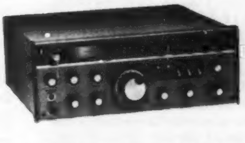

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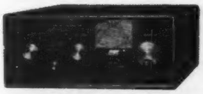

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ROSS' $$$$ NEW April SPECIALS: KENWOOD TL-922A $1395.90, TM-221A $387.90, TM-721A $617.90, TS-140S $789.90, TW-4100A $464.90. DENTRON GLA-1000C $389.90. ICOM 2KL $1689.90, 725 $819.90, IC-3200A $469.90, 4AT $269.90, AMP SUPPLY AL-80A $889.90, AL-84 $459.90, LA-1000NT $619.90, LK-450 $849.90, LK-550NTC $2059.90, LK-800NTX $3150.00. TEN-TEC 425E $2459.90, MAGUS MA-1000B $819.90. YAESU FL-7000 $1724.00. ALL L.T.O. (Limited Time Offer) LOOKING FOR SOMETHING NOT LISTED?? CALL OR WRITE. Over 8780 ham-related items in stock for immediate shipment. *Mention ad.* Prices cash, F.O.B. PRESTON. WE CLOSE AT 2:00 P.M. MONDAYS & ALL DAY SATURDAY. ROSS DISTRIBUTING COMPANY, 78 SOUTH STATE, (P.O. Box 234H), PRESTON ID 83263. 208-852-0830. BNB654

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No discounts or commissions are available. Copy must be received in Peterborough by the first of the second month preceding the cover date. Make checks payable to *73* Magazine and send to: Rebecca L. Niemela, **Barter 'N' Buy, *73* Magazine, WGE Center, Peterborough NH 03458.**

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$50 PACKET DIGICOM>64—software based PACKET system for Commodore 64. Software is public domain and requires a modem for the C-64 which is provided by our kit. Board plugs directly into cassette port or remote mounted via cable, both connectors included. Watchdog timer, reed relay PTT and PTT inversion options included. Power derived from computer. Uses 7910 chip - no alignment required. Switch allows HF or VHF operation. Order KIT#154 for $49.95 or ASSEMBLY#154 for $79.95, both include FREE DISC. Add $2.50 S&H per order. A & A Engineering, 2521 W. La Palma, #K, Anaheim CA 92801; 714-952-2114. MC or VISA accepted. BNB732

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HAM RADIO REPAIR, all makes, models. Experienced reliable service Robert Hall Electronics, Box 280363, San Francisco, CA 94128-0363; 408-729-8200. BNB751

WANTED: Ham Equipment and other property. The Radio Club of Junior High School 22 NYC, Inc., is a non-profit organization, granted 501(C)(3) status by the IRS, incorporated with the goal of using the theme of ham radio to further and enhance the education of young people nationwide. Your property donation or financial support would be greatly appreciated and acknowledged with a receipt for your tax-deductible contribution. In Dayton meet the Crew from 22 and relax at our flea market table, check in on 144.30 simplex. Please write us at: PO Box 1052, New York, NY 10002, or call our round-the-clock hotline: (516) 674-4072. Thank you! BNB762

COMPUTER CODE COURSE. Apple II +/c/e/GS. C-64/128. 37 Modes, Graphics, 1-100 WPM, menus, proportional spacing, variable frequency, more ($29.95). With wordprocessor ($39.95). Manual ($10). Check/MO. LARESCO, POB 2018-ST, Calumet City IL 60409. 1-312-891-3279. BNB764

INDIVIDUAL PHOTOFACT FOLDERS. #10 to #1400, $4.00. #1401 up, $6.00. Sam's books, $7.00. Postpaid. Allen Loeb, 414 Chestnut Lane, East Meadow NY 11554. BNB766

VHF TO MICROWAVE: GaAsFETs, MMICs, transistors, etc. SASE; WA31AC, 7148 Montague St., Philadelphia PA 19135. BNB771

HAMLOG COMPUTER PROGRAM Full features. 17 modules. Auto-logs, 7-band WAS/DXCC. Apple $19.95. IBM, CP/M, KAYPRO, TANDY, CR8 $24.95. 73-KA1AWH, PB 2015, Peabody MA 01960. BNB775

WANTED: Sunair GCU-910A or GCU-935 Antenna Coupler. Ray Dunham, 1030 Hillside Ave., Pacific Grove CA 93950. BNB790

ELECTRON TUBES: All types & sizes. Transmitting Receiving, Microwave... Large inventory = same day shipping. Ask about our 3-500Z special. Daily Electronics, PO Box 5029 Compton, CA 90224. 800-346-6667. BNB792

R-390A RECEIVER PARTS: Info SASE. CPRC-26 military Manpack Radio, 6 meter FM, with antenna, crystal, handset: $22.50, $42.50/pair. CPRC-26 Radio only: $9.50. Add $4.50/piece shipping, $9 maximum. Baytronics, Box 591, Sandusky OH 44870. BNB798

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BARRY ELECTRONICS sells two-way Radio for GVT, Business, Security, etc. MOTOROLA, ICOM, YAESU, UNIDEN, REGENCY, KING, ETC. Best prices. Open 7 days. Full service, lab on premises. We ship Worldwide. Write or call (212) 925–7000, BARRY ELECTRONICS, 512 Broadway, New York NY 10012. FAX (212) 925–7001. BNB832

XV223-49 FM TRANSVERTER KIT, includes case, $89ppd. XT-80 5w/80m CW Transmitter Kit, $29ppd. LAKETEK ELECTRONICS, P.O. Box 2496-ST, Sandusky OH 44870. BNB834

MAGAZINES WANTED: "Microwave Systems News" (MSN), "RF Design," "PCIM (Power Conversion & Intelligent Motion)," and "QEX" (1980–present). Call collect 519–742–4594 (Ontario) after 6 PM Eastern time. BNB841

RADIO SHACK DEALER Lowest prices nationwide on all RS equipment. Special New HTX 100 10M Transceiver, Reg. $259.95, Sale $254. No tax out of Florida. Special—Pro-2004 Scanner, Reg. $419.95, Sale $399.95. PRO-34, Reg. $329.95, Sale $299.95. DX 440 Digital SW, Reg. $199, Sale $189.95. Save big on power supplies in all sizes. Also antennas and accessories. Order toll free 1–800–848–3004, or (407) 286–3041 for other information. Cotronics Inc., Radio Shack Dealer, 2200 S.E. Federal Highway, Stuart FL 34994. BNB842

AMIGA AUTHORIZED DEALER Lowest prices nationwide. Call for specials on the Amiga A-500. Save big on all Amiga prices. **Cotronics Inc., Amiga Authorized Dealer,** 2200 S.E. Federal Highway, Stuart FL 34994. Order toll free **1–800–848–3004.** BNB843

HOME-BREW PROJECTS Lists for SASE. WB2EUF, Box 708, East Hampton NY 11937. BNB845

IS MY ATLAS RADIO STOLEN? N.Y.C. supplier of "Atlas" radios shipped me a DD 6 Digital display. Doesn't work. If it's yours and you can prove it, call Don 203–274–8625 after 6 PM. BNB846

UNIQUE WAY TO LEARN OR UPGRADE: "CODE CRUNCHER," comfortable, computer-based learning aid that works! Modifiable, adjustable in 60 increments from 2 to 20+ WPM. Code from keyboard, ASCII file or random generator. BASIC code only (requires 13KB) with instructions, $8. IBM-format disk, instructions, source code, $12. More info? SASE. D.S. Yetman, 10 High St., Merrimac MA 01860. BNB855

DIGITAL AUTOMATIC DISPLAYS. Any Radio. Be specific. GRAND SYSTEMS, Dept. A, PO Box 3377, Blaine WA 98230. BNB856

COMMODORE-128 PROGRAM available to track the Amateur Satellites. Uses KEPLERIAN data supplied by NASA free. Tracks up to 8 satellites simultaneously. Program also supports printing schedules and predictions for Satellites. Use it to track MIR and talk to the Cosmonauts. SATRAK128, $26.50 includes shipping. Other information on this or other programs for the C128, requires a business size SASE. Reid Bristor WA4UPD, PO Box 0773, Melbourne FL 32936-0773. BNB857

HAM GOSPEL TRACTS Free, SASE. N3FTT, 5133 Gramercy Dr., Clifton Hts. PA 19018. BNB858

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100 QSL CARDS $8! Shipped postpaid. Free samples. Shell Printing, KD9KW, PO Box 50A, Rockton IL 61072. BNB859

MORSE CODE—LEARN THE EASY WAY with our subliminal tapes. 2 tapes, $19.95. Send Money Order or Check to R. Koestek/W2EKY, PO Box 15, Stockholm NJ 07460. BNB861

WANTED: Copy of AMTOR PROM chips for Microlog ATR-6800. Company no longer supports this equipment. Will pay reasonable price. P. Malloy, PO Box 155, Limestone ME 04750. BNB862

C64 SOFTWARE. Schematic & PC Board Fonts, Electronic Programs & Dictionary. For C64 or C128 with Geos.™ Send $19.95 or write: Thomas Software, 1375 Beaseley Rd., Jackson MS 39206. BNB863

HOSSTRADERS flea market returns to Deerfield NH June 3. SASE for info. WA1IVB, RFD Box 57, West Baldwin ME 04091. BNB864

THE NATIONAL HAM SHOPPER. A bi-monthly buy, sell, trade publication (starting in April). Adds are quickly answered and published for fast results. $12/per year. $22.00/per 2 year subscription rate. Ad rates 0.30/word individuals; 0.90/word commercial. Send to PO Box 10738, Elmwood CT 06110. BNB865

ANTENNA PARTS CATALOG, LOWEST COSTS: Dipole/Quad/Ground Radial WIRE, insulators, FLEXWEAVE #14-168 strand, center feeds, OPEN WIRE FEED LINE, coax, remote coax switches, relays. Catalog: $2.00. Davis RF, PO Box 230-S, Carlisle MA 01741. (508) 369–1736. BNB866

NICADS QUICK CHARGE "AA" 500 mAh. 10 for $12.00 plus $1.85 shipping; "AAA" 4 for $5.50, US made silver teflon PL259, 10 for $15.00 plus $1.85 shipping. Raymond Richard, 5113 Town Ridge, Middletown CT 06457. BNB867

COMMODORE VIC-20 COMPUTER mint condition—$49. Postpaid, R. Christie, 215-28 Spencer Ave., Queens Village NY 11427. BNB868

HANDICAPPED NOVICE needs HF equipment donated—anything, please. KA3OVE, (412) 531–7443 anytime. BNB869

THE 11TH ANNUAL TSRAC WHEELING HAMFEST/COMPUTER FAIR, Sunday, May 21, Wheeling Park, 8 AM to 3 PM. WV's largest hamfest. Dealers welcome, under roof. Free flea market, admission only. Family Hamfest: WOMEN FREE, Children 14 under free. Admission $3.00 in advance—$4.00 at door. Contact: TSRAC, Box 240, RD 1, Adena OH 43901. (614) 546–3930. BNB870

PERSONALIZE YOUR SHACK! Engraved plastic name tags, station callsigns, and desk plates. Most colors available. 2001 Washington Ave., Sanford FL 32771. BNB871

ICOM R7000 RECEIVER New in carton, $800. AEA PK 232, New with instructions, $200. D. DuVal; 11 Virginia Place; Larchmont NY 10538. (914) 833–0008. BNB872

ROCKY MOUNTAIN AMATEUR/SHORTWAVE SPECIALIST. New Specials "While Stocks Last." Yaesu FT-4700 RH dual band $729, FRG 8800 $599, FT-757 GXII $919, FT-411 2M $337. TEN-TEC Paragon $1819. Prices cash, F.O.B. Englewood CO. (Mention ad.) Allied Appliance & Radio, 4253 So. Broadway, Englewood Co 80110. (303) 761-7305. BNB873

Number 39 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8½" x 11") sheet of paper. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. Thank you for your cooperation.

Has anyone transistorized Heathkit's HG 10B VFO? Tubes: 6CH8 cathode follower oscillator, OB2 voltage regulator. Any modifications on the HR10B receiver or DX60 Transmitter would also be appreciated.

K. Neal
HCR 62-222
Flippin AR 72634

I need operation or service manuals for a linear amplifier, type CL-11, from Communications Associates, Inc.,and for a frequency counter, Model 1500A, from Monsanto. I will pay for use and copying costs. Does anyone have current addresses for these companies?

Mike Adams N4EVS
6333 Hwy. 2321, Deer Point
Panama City FL 32404

Does anyone have a schematic or information on the serial RS232 board (RS PN. 26-1145) used in the TRS-80 Model I? I need this board so that I can get on RTTY.

Dan R. Johnson KG4MD
U.S. Naval Hospital
Box 36
FBPO Norfolk VA 23593

Need Manual and/or schematic for the Lafayette HA-600A receiver. Will pay costs.

John Stryker N2IKX
RD #4, Box 219
Hammonton NJ 08037

I need a schematic, parts list, or information on a Klitzing UHF linear amplifier, Model 70CM10W60A. I will gladly pay postage and copying costs. Thank you.

Allen Fugelseth WB6RWU
4230 Trotter St.
Capitola CA 95010

Want commercially made printed circuit board for the "CMOS SUPER KEYER" as described in the 1988 ARRL Handbook section 29-3. also want service manual for U.S. Army "Terminal Telegraph 1H-5/TG."

Lionel L. Sharp VK4NS
19 Kelso St.
Chermside, Brisbane
Queensland Australia

We are a middle school of 1100 students, with over a hundred students interested in starting up a ham club. This club will be worked into a class in the Fall '89 semester. We are looking for any type of amateur radio equipment and publications. We are also looking for amateur radio software to run on an IBM PC.

Craig Hardy KB5EFG
Donny Bickham Middle School
6470 Old Mooringsport Rd.
Shreveport LA 71107

Number 40 on your Feedback card

QTH-DX

QTH Antarctica

Leon Fletcher N6HYK
274 Webster Drive
Ben Lomond CA 95005

Brent Jones KB1UK, who for most of this year is operating as KC4AAA from the United States' Amundsen-Scott South Pole Station, spends nearly all his time inside a geodesic dome 164 feet wide, 53 feet high.

"In this protective dome," he told me during a rag-chew on 15 meters, "the temperature stays around minus 35 degrees Fahrenheit." Jones considers that frigid indoor clime "comfortable." Outside the dome, temperatures average minus 76 in the deep winter of July, and get as low as minus 117. The warmest day ever was only 3.1 degrees F.

The dome covers three modular buildings. One houses the galley, dining hall, and some recreational facilities. Another structure contains most of the berthing. The third, the "Science Building," contains the laboratories in which scientists research such fields as glaciology, geophysics, meteorology, and upper atmosphere physics.

Outside the dome, a quarter-mile away, are Quonset-type buildings, covered with canvas-like material, which provide living quarters for the additional scientists who come during the summer.

But during the winter—between mid-February and early November—the station is completely isolated. Not even mail gets in or out. That isolation is eased greatly through hamming. Phone patches to stateside relatives and friends are one of the highlights of life in Antarctica. And in the United States, numerous hams are on the air—some regularly, some occasionally—to handle the patches, usually around 14,240 to 14,250 kHz, at about 0300 UTC.

Land of Extremes

It's understandable why hamming would be popular here in this harsh, desolate land. A spokesman for the National Science Foundation, Walter Seelig, says that, of all the continents, Antarctica is "The coldest, windiest, highest, and driest."

The statistics behind those claims are startling.

- Coldest: Antarctica holds the all-time world record for cold—minus 126.9 degrees F, recorded in Vostok on August 24, 1960. Antarctica averages 20 degrees F colder than the Arctic.
- Windiest: the strongest winds in the world—up to 200 miles an hour—blow through Antarctica's Cape Denison, nicknamed "Home of the Blizzard."
- Highest: Antarctica is more than four times higher than any other continent. Its average altitude is about 14,000 feet, including an 8,000-foot cover of ice and snow.
- Driest: it rarely rains in Antarctica. Even the snow, when melted, totals only about 10 to 20 inches of water a year in the wettest areas, along the coasts. Scientists estimate the average amount of precipitation over the entire continent to be only two to four inches per year.

One Country, Many Prefixes

Hamming from Antarctica, according to the ARRL's latest "DXCC Countries List," can come from at least 14 different prefixes. The named prefixes are:

AT0 (India)
CE9 (Chile)
DP0 (Germany)
FT8Y (France)
KC4 (USA)
LU (Argentina)
OR4(Belgium)
VK0 (Australia)
VP8 (Britain)
Y8 (Indonesia)
ZL5 (New Zealand)
ZS1 (South Africa)
ZX0 (Brazil)
3Y (Norway)
4K1 (USSR)
8J1 (Indonesia)

Despite the array of prefixes, all of Antarctica counts—under ARRL rules—as just one DX country. Yet claims to territorial sovereignty in Antarctica, according to a U.S. Department of State publication, have been made by seven countries: Argentina, Australia, Chile, France, New Zealand, Norway, and the United Kingdom.

History, Geography, Flora, and Fauna

Exploration of Antarctica began about A.D. 650, according to "credible legends among Polynesians," as historian William Bixby puts it. That's when islanders in a large ocean-going canoe became the first humans to sight the ice of this strange continent.

In 1772–1775, English explorer James Cook was the first to sail completely around Antarctica, but he never saw the landmass itself.

> ***"Antarctica is the coldest, windiest, highest, and driest (continent)."***

The first sighting didn't happen until nearly 50 years later, on January 30, 1820, when British naval officer Edward Bransfield explored the area.

Ninety-one years after that, the ultimate was attained. On December 14, 1911, a Norwegian expedition led by Roald Amundsen was the first to stand at the South Pole. But it was only 31 years ago, on March 2, 1958, that the first crossing of the continent was completed by British explorers led by Vivian Fuchs.

Antarctica is almost circular and covers 5.4 million square miles, about the size of the continental United States and Mexico. It contains nearly ten percent of all land in the world. Its 18,648-mile coastline is more than 50 percent longer than that of the United States.

Because temperatures rarely get above freezing, the continent is virtually lifeless. It has no forests, brushes, or grasslands. The vegetation—mostly lichens, bryophytes, and algae—rarely grows to over two inches high. But there are almost 400 species of mosses, and about 200 species of freshwater algae.

Animal life is somewhat more abundant. There are 17 species of penguins, including three found nowhere else: the Adelie penguin, the most common of all birds in the Antarctic; the Chinstrap, the smallest penguin; and the Emperor, the largest, growing to about 38 inches tall and weighing up to 80 pounds. Other species of birds include gulls, terns, and albatrosses. Seals used to be plentiful in the waters off Antarctica, but by the 1850s, commercial hunters had killed all of the continent's fur-bearing seals.

Whales still abound in Antarctic seas, despite mass killings by the whaling industry. The largest animal known to have existed in the world was a giant blue whale caught off Antarctica: it was 124 feet long and estimated to weigh about a ton a foot.

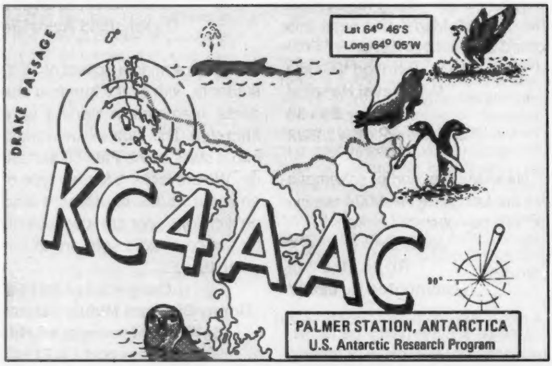
The natural resources of Antarctica are considered to be the most worthless of all the continents. There are traces of nickel, copper, iron, gold, and other minerals, but not enough of any of them has been found to make mining worthwhile.

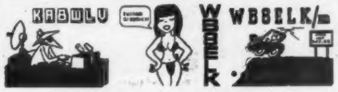
The Future

Nevertheless, research continues. All activities must be "exclusively for peaceful purposes," according to the Antarctic Treaty of 1959, signed by 12 nations and later endorsed by 26 additional countries. Military bases, fortifications, nuclear explosions, and disposal of radioactive waste are specifically forbidden.

The latest published report says that Antarctica has 52 year-round scientific outposts, representing 14 countries. The United States maintains four year-round research centers: McMurdo, the largest; Siple, the smallest; Palmer; and the South Pole station.

Presumably, all the staffers at all those stations would agree with James Cook, that first Antarctic explorer, who described the area as "Lands doomed by nature to perpetual frigidness...whose horrible and savage aspect I have not words to describe." ■





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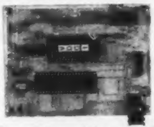

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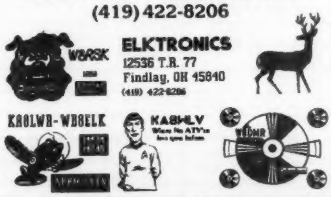

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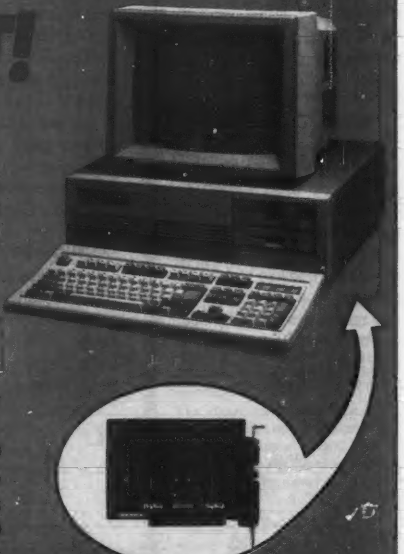

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CIRCLE 239 ON READER SERVICE CARD

Number 41 on your Feedback card

PROPAGATION

by Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

Good DX Activity

April will be nearly as good as March with respect to HF propagation. All the HF bands will be very active during the day, and most will continue to provide good DX until long after dark—including 10 meters! Six meters will close around or shortly after dark, but you can expect superb 6 meter DX on many days of the month.

Solar flux will be high during most days, but the penalty for an increasingly active sun will be frequent flares and major solar events, all of which adversely affect the earth's magnetic field. This means that, although the solar flux will greatly enhance the ionosphere, an active magnetic field surrounding earth will prevent many DX contacts to those areas where you most want them. However, the north-south paths will be open and transequatorial propagation will be good on those days when east-west and over-the-pole propagation won't be available on bands above 40 meters.

Ionospheric Disturbances

The biggest problem we will have to face is some very disturbed ionospheric and possibly geophysical upsets (storms, volcanism, and earthquakes) during the first week of the month. The earth's magnetic field will possibly reach storm levels that week, notably from the 1st through the 7th, and most days the magnetic field will be unsettled-to-active, at the very least.

Typical of unsettled-to-active magnetic field conditions, propagation will be "spotty" on all bands. There will be frequent "echo" signals on bands above 30 meters and "blackouts" on some bands on a couple of days due to solar flares. This is not to imply that all of these conditions will occur each day, but it does mean that you can expect any one, or a combination of these conditions, during this period.

Excessive Ionization

Readers should note that the ionosphere can become too ionized. This causes signal absorption on the lower bands (80, 40, 30) during the day, and these bands won't even begin to sound good until after dark or late afternoon at the earliest. It seems that you can't have everything all at the same time when it comes to good DX "conditions." For best results on 160–30 meters, try early mornings and early evenings.

Note that, when making forecasts at least three months in advance of the time we're considering, it isn't possible to tie any single event to a particular day. The best we can do is to indicate a period within a week that is likely to exhibit the phenomena indicated on the chart.

The rest of the month is likely to be very good, with the exception of a day or two on either side of the 21st, when conditions will be only fair, and possibly poor for one day.

Looking Back (or Ahead?)

It's always interesting to look at the predictions made several months ago. As I write this column, it's mid-January, and I have the opportunity to evaluate my predictions to see how January followed the forecast. One thing is immediately apparent: The propagation is even better than I had expected. I mentioned that solar flux values would be holding well above 150. I didn't expect them to be well above 250! On a couple of days we had values above 290!

Otherwise, so far the forecast is bearing up pretty well under the load of facts. Last week (between the 9th and the 16th) conditions did exhibit very high "A" index values (A = 27 on one or two days) as predicted, and there were very unsettled-to-active magnetic field conditions.

The VHF/UHF contest is in full swing this weekend as I write, and, also as predicted, there have been some good openings.

Looking back over the month's predictions, I find that some were remarkably and even exactly "on target," while a few missed entirely. All in all, it is 80% accurate, which, given the present state of our knowledge, is about the best we can hope for.

Meanwhile, have fun, and, as always, keep that radio tuned to WWV at 18 minutes after each hour to keep up with propagation and solar-geophysical events. See you next month. Good DX! ■

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	–	–	–	–	–	20	–	–	–	–
ARGENTINA	15	20	20	20	40	–	–	–	15	10	10	10
AUSTRALIA	15	20	20	20	20	–	40	20	–	–	–	15
CANAL ZONE	20	20	20	20	40	–	–	15	15	10	10	10
ENGLAND	–	40	80	40	–	–	20	15	15	10	15	20
HAWAII	15	15	20	20	40	40	40	20	20	–	–	10
INDIA	–	–	–	–	–	–	–	–	–	–	–	–
JAPAN	15	20	–	–	–	–	–	20	–	–	–	–
MEXICO	20	20	20	20	40	–	–	15	15	10	10	10
PHILIPPINES	–	–	–	–	–	–	–	20	–	–	–	–
PUERTO RICO	20	20	20	20	40	–	–	15	15	10	10	10
SOUTH AFRICA	20	–	40	–	–	–	–	–	–	10	15	20
U. S. S. R.	–	40	–	–	–	–	–	20	15	20	–	–
WEST COAST	15	20	20	40/80	80	–	–	–	–	15	10	10

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	20	20	–	–	40	20/40	20	–	–	–
ARGENTINA	15	15	20	20	40	40	–	–	–	–	10	10
AUSTRALIA	15	15	20	20	20	–	40/80	40/80	–	–	15	15
CANAL ZONE	10	10	20	40	40	40	–	15	15	10	10	10
ENGLAND	40	40	–	–	–	–	–	20	15	15	15	20
HAWAII	10	15	20	20	40	40	–	20	20	15/20	15	10
INDIA	–	–	–	–	–	–	20	20	–	–	–	–
JAPAN	15	20	20	20	–	–	40	20/40	20	–	–	–
MEXICO	10	10	20	40	40	40	–	15	15	10	10	10
PHILIPPINES	15	15/20	–	–	–	–	–	20	20	–	–	–
PUERTO RICO	10	10	20	40	40	40	–	15	15	10	10	10
SOUTH AFRICA	20	20	–	–	–	–	–	–	15	15	15	15
U. S. S. R.	–	–	–	–	–	–	–	20	15	15	20	–

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	15	20	20	20	20	40	40	–	–	–	15
ARGENTINA	15	20	20	40	–	–	–	–	–	–	10	10
AUSTRALIA	10	15	20	20	20	–	40	–	20	20	–	15
CANAL ZONE	20	20	20	40	40	–	–	–	15/20	15	10	10
ENGLAND	–	–	–	–	–	–	–	–	20	20*	20*	20
HAWAII	10	15	15	40	40	40	40	40	–	20	20	20
INDIA	–	15	15/20	–	–	–	–	–	20	–	–	–
JAPAN	10	15	15	20	20	20	40	40	–	–	15	15
MEXICO	20	20	20	40	40	–	–	–	15/20	15	10	10
PHILIPPINES	15	15	20	20	20	–	–	–	20	15/20	15/20	15
PUERTO RICO	20	20	20	40	40	–	–	–	15/20	15	10	10
SOUTH AFRICA	20	20	–	–	–	–	–	–	–	–	15	20
U. S. S. R.	–	–	–	–	–	–	–	–	20	–	–	–
EAST COAST	15	20	20	40/80	80	–	–	–	–	15	10	10

APRIL

SUN	MON	TUE	WED	THU	FRI	SAT
						1 P
2 F–P	3 F–P	4 F–P	5 P	6 P	7 P–F	8 F
9 F	10 F–P	11 P	12 P–F	13 F–G	14 G	15 G–F
16 F–G	17 G	18 G–F	19 F–P	20 F	21 F–G	22 G
23 G 30 G	24 G	25 G	26 G–F	27 G	28 G	29 G

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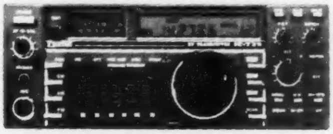

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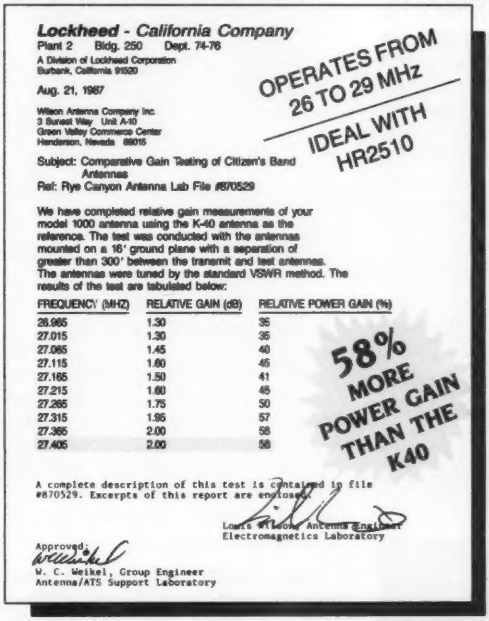

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A Division of Lockheed Corporation
Burbank, California 91520

Aug. 21, 1987

Wilson Antenna Company Inc.
3 Sunset Way Unit A-10
Green Valley Commerce Center
Henderson, Nevada 89015

Subject: Comparative Gain Testing of Citizen's Band Antennas
Ref: Rye Canyon Antenna Lab File #870529

We have completed relative gain measurements of your model 1000 antenna using the K-40 antenna as the reference. The test was conducted with the antennas mounted on a 16' ground plane with a separation of greater than 300' between the transmit and test antennas. The antennas were tuned by the standard VSWR method. The results of the test are tabulated below:

FREQUENCY (MHZ)	RELATIVE GAIN (dB)	RELATIVE POWER GAIN (%)
26.965	1.30	35
27.015	1.30	35
27.065	1.45	40
27.115	1.60	45
27.165	1.50	41
27.215	1.60	45
27.265	1.75	50
27.315	1.95	57
27.365	2.00	58
27.405	2.00	58

A complete description of this test is contained in file #870529. Excerpts of this report are enclosed.

Louis Wilson, Antenna Engineer
Electromagnetics Laboratory

Approved:
W. C. Weikel, Group Engineer
Antenna/ATS Support Laboratory

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It's a lesson you learn very early in life. Many can be good, some may be better, but only one can be the best. The PK-232 is the best multi-mode data controller you can buy.

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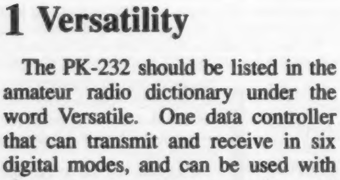
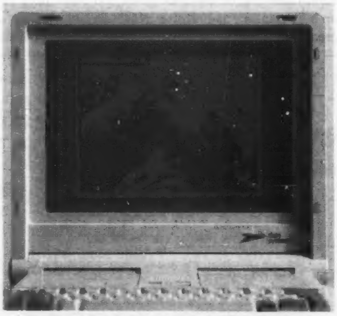
The PK-232 should be listed in the amateur radio dictionary under the word Versatile. One data controller that can transmit and receive in six digital modes, and can be used with almost every computer or data terminal. You can even monitor Navtex, the new marine weather and navigational system. Don't forget two radio ports for both VHF and HF, and a no compromise VHF/HF/CW internal modem with an eight pole bandpass filter followed by a limiter discriminator with automatic threshold control.

The internal decoding program (SIAM(tm)) feature can even identify different types of signals for you, including some simple types of RTTY encryption. The only software your computer needs is a terminal program.



PC Pakratt Packet TX/RX Display



Facsimile Screen Display

2 Software Support

While you can use most modem or communications programs with the PK-232, AEA has two very special packages available exclusively for the PK-232....PC Pakratt with Fax for IBM PC and compatible computers, and Com Pakratt with Fax for the Commodore 64 and 128.

Each package includes a terminal program with split screen display, QSO buffer, disk storage of received data, and printer operation, and a second program for transmission/reception and screen display of facsimile signals. The IBM programs are on 5-1/4" disk and the Commodore programs are plug-in ROM cartridges.

3 Proven Winner

No matter what computer or terminal you plan to use, the PK-232 is the best choice for a multi-mode data controller. Over 20,000 amateurs around the world have on-air tested the PK-232 for you. They, along with most major U.S. amateur magazines, have reviewed the PK-232 and found it to be a good value and excellent addition to the ham station.

No other multi-mode controller offers the features and performance of the PK-232. Don't be fooled by imitations. Ask your friends, or call the local amateur radio store. We're confident the PK-232 reputation will convince you that it's time to order your very own PK-232.

Call an authorized AEA dealer today. You deserve the best you can buy, you deserve the PK- 232.

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AEA **Brings you the Breakthrough!**

CIRCLE 65 ON READER SERVICE CARD

A high-performance HF rig… with a great receiver and full-power transmitter. Light in weight and low in price.

This is Yaesu's FT-747GX.

Whether you're a novice or a veteran, it's a great way to start. And a great way to go.

DX ready. The 747 packs a full 100-watt RF punch on 160 to 10 meters, with continuous receive from 100 kHz to 30 MHz.

And its control panel is refreshingly simple. So you can hop around the band *fast* to nail those DX stations. While other guys are warming up their amplifiers, you can be working the DX!

Multimode versatility. The FT-747GX is ready to go on LSB, USB, CW, and AM. With provision for the FM-747 FM unit—great for watching 10-meter repeaters.

You get 20 memories to store frequency and mode. Dual VFOs with split frequency operation for DX-pedition work. And manual band scan plus auto-resume memory scan via the microphone up/down buttons.

Great receiver. Utilizing a directly-driven mixer, the FT-747GX receiver features superb overload protection. You also get factory-installed narrow CW *and* AM filters. A one-touch noise blanker. All-mode squelch. RIT. And a 20-dB attenuator for local QSOs.

Lightweight construction. Housed in a metallized high-impact plastic case, the FT-747GX weighs in at about 7¼ pounds! With the loudspeaker mounted on the front panel for maximum audio transfer. And internal heatsinking for the transmitter, rated at full power for FM, packet, RTTY, SSTV, and AMTOR when used with a heavy-duty power supply.

Available options. FC-1000 or FC-757AT Automatic Antenna Tuners. FL-7000 500-watt Automatic, Solid-State Linear Amplifier. TCXO-747 Temperature-Compensated Crystal Oscillator. FAS-1-4R Remote Antenna Selector. FRB-757 Amplifier Relay Box. FP-700 Standard Power Supply. FP-757HD Heavy-Duty Power Supply. MMB-38 Mobile Mounting Bracket.

Discover the price/performance leader. Check out Yaesu's low-cost FT-747GX at your Yaesu dealer today. Because now, Yaesu puts priceless DX into *your* price range.

Yaesu USA 17210 Edwards Road, Cerritos, CA 90701 (213) 404-2700. **Repair Service:** (213) 404-4884. **Parts:** (213) 404-4847. Prices and specifications subject to change without notice.

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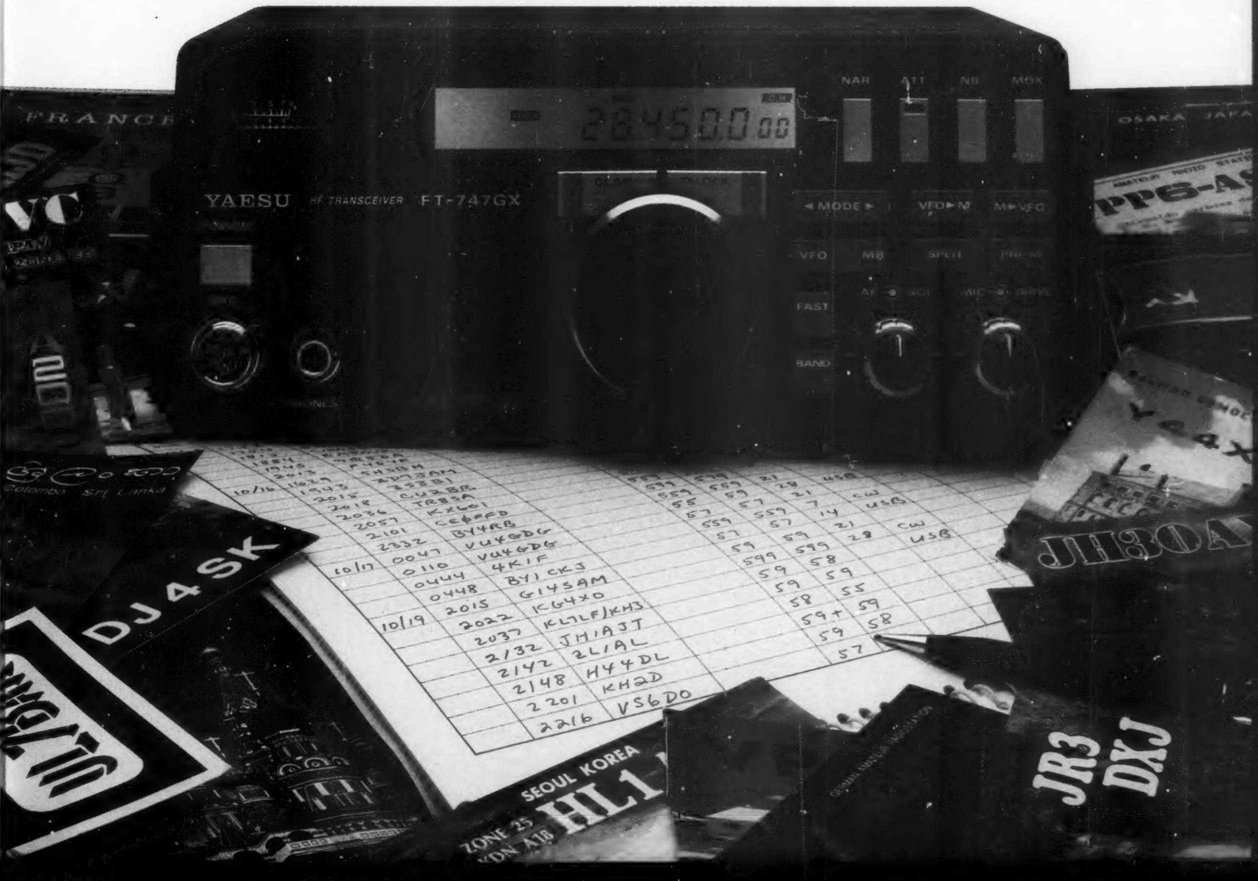
CIRCLE 165 ON READER SERVICE CARD

Fill your logbook. Without emptying your pocketbook.



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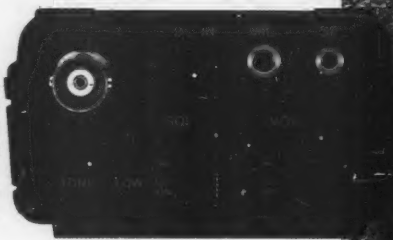
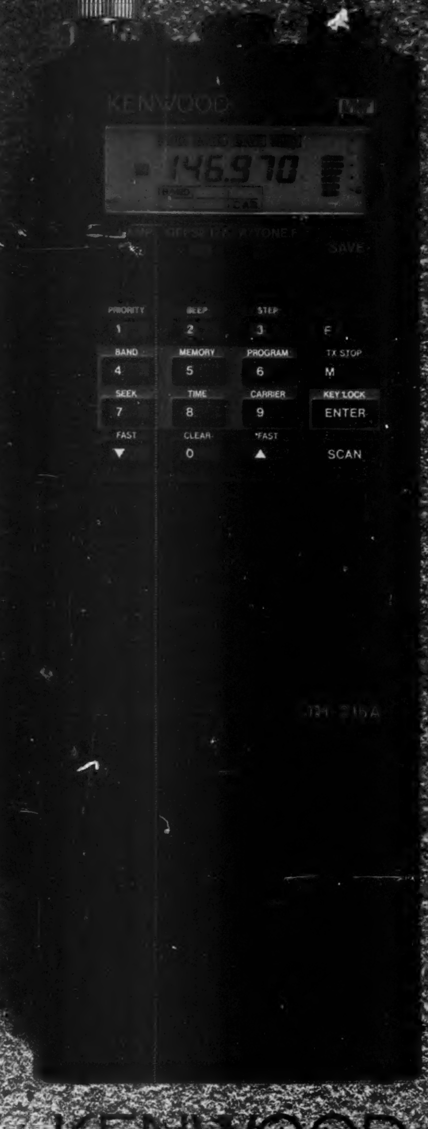
TH-315A
Here Now!

This HT Has it All!

TH-215A/315A/415A

Full-featured Hand-held Transceivers





Kenwood brings you the greatest hand-held transceiver ever! More than just "big rig performance," the new TH-215A for 2 m, TH-315A for 220 MHz, and TH-415A for 70 cm pack the most features and the best performance in a handy size. And our full line of accessories will let you go from hamshack to portable to mobile with the greatest of ease!

- **Wide receiver frequency range.** Receives from 141-163 MHz. Includes the weather channels! Transmit from 144-148 MHz. Modifiable to cover 141-151 MHz (MARS or CAP permit required).
- **TH-315A covers 220-225 MHz, TH-415A covers 440-449.995 MHz.**
- **5, 2.5, or 1.5 W output, depending on the power source.** Supplied battery pack (PB-2) provides 2.5 W output. Optional NiCd packs for extended operation or higher RF output available.
- **CTCSS encoder built-in.** TSU-4 CTCSS **decoder** optional.
- **10 memory channels store any offset, in 100-kHz steps.**
- **Odd split, any frequency TX or RX, in memory channel "0."**
- **Nine types of scanning!** Including new **"seek scan" and priority alert.** Also memory channel lock-out.
- **Intelligent 2-way battery saver circuit extends battery life.** Two battery-saver modes to choose, with power saver ratio selection.
- **Easy memory recall.** Simply press the channel number!
- **12 VDC input terminal for direct mobile or base station supply operation.** When 12 volts applied, RF output is 5 W! (Cable supplied!)
- **New Twist-Lok Positive-Connect™ locking battery case.**
- **Priority alert function.**
- **Monitor switch to defeat squelch.** Used to check the frequency when CTCSS encode/decode is used or when squelch is on.
- **Large, easy-to-read multi-function LCD display with night light.**
- **Audible beeper to confirm keypad operation.** The beeper has a unique tone for each key. DTMF monitor also included.
- **Supplied accessories:** Belt hook, rubber flex antenna, PB-2 standard NiCd battery pack (for 2.5 W operation), wall charger, DC cable, dust caps.

Optional Accessories:
• PB-1: 12 V, 800 mAH NiCd pack for 5 W output • PB-2: 8.4 V, 500 mAH NiCd pack (2.5 W output) • PB-3: 7.2 V, 800 mAH NiCd pack (1.5 W output) • PB-4: 7.2 V, 1600 mAH NiCd pack (1.5 W output) • BT-5 AA cell manganese/alkaline battery case • BC-7 rapid charger for PB-1, 2, 3, or 4 • BC-8 compact battery charger • SMC-30 speaker microphone • SC-12, 13 soft cases • RA-3, 5 telescoping antennas • RA-8B StubbyDuk antenna • TSU-4 CTCSS decode unit • VB-2530: 2m, 25 W amplifier (1-4 W input) • LH-4, 5 leather cases • MB-4 mobile bracket • BH-5 swivel mount • PG-2V extra DC cable • PG-3D cigarette lighter cord with filter

Complete service manuals are available for all Kenwood transceivers and most accessories.
Specifications and prices are subject to change without notice or obligation.

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